DOCUMENT RESUME

ED 249 199 SP 025 282

TITLE	Food Power. A Coach's Guide to Improving Performance.
INSTITUTION	National Dairy Council, Rosemont, Ill.
PUB DATE	84
NOTE	56p.
AVAILABLE FROM	National Dairy Council, 6300 River Road, Rosemont, IL 60018.
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Athletes; *Athletic Coaches; Athletics; Body Weight; Dietetics; *Exercise Physiology; Fatigue (Biology); *Human Body; Metabolism; *Nutrition; Nutrition Instruction; Training Methods; Water

ABSTRACT

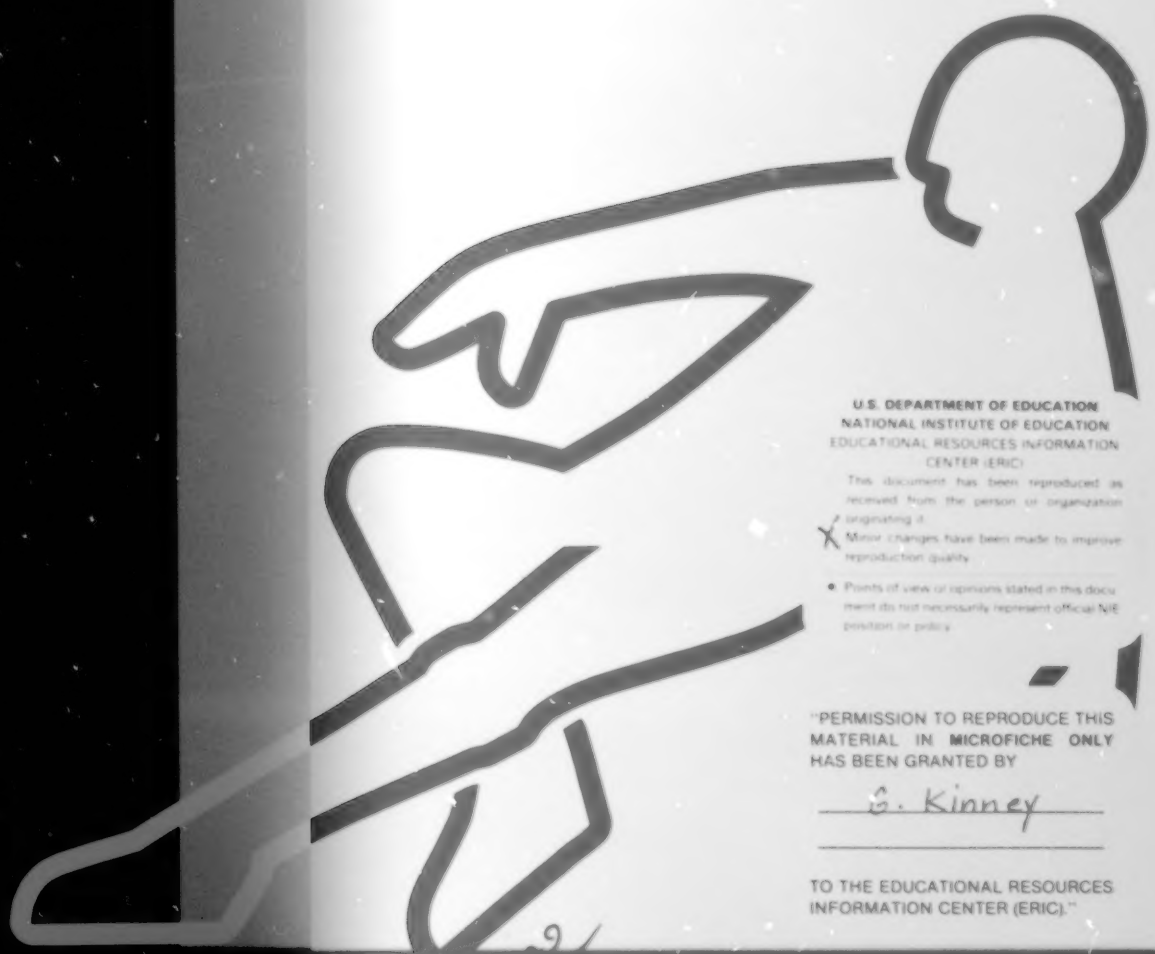
This guide looks at the athlete's nutrient needs and presents recent findings from physiology- and nutrition-related research which have direct bearing on athletic performance. Contents include sections on: (1) nutrition basics; (2) water needs of athletes; (3) nutrient fuels for sports; (4) diets for athletes; (5) body composition; (6) weight control; (7) myths about sports and nutrition; and (8) appended lists of foods, recommended daily dietary allowances, and sources for skinfold calipers. Twelve handouts for athletes are included which contain highlights on basic information on nutrition, diet, and training. This information is combined with instructions to athletes for reaching their nutritional peak for competition. (JD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 249199

FOOD POWER

A COACH'S GUIDE TO IMPROVING PERFORMANCE



SP 025 282

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

X Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

S. Kinney

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

INTRODUCTION

Aside from heredity and training, no single factor plays a bigger role in the quality of athletic performance than diet. But despite the wealth of information on nutrition in general, few efforts have been made to describe the nutritional needs and the best dietary regimen for training and competing athletes.

This is not to say that coaches, trainers, and athletes don't feel nutrition is important. To the contrary, all persons engaged in sports have, at one time, hoped and searched for the "magic food" that would help them win.

Unfortunately, in their quest for success, most athletes are willing to try any dietary regimen or nutritional supplement. In a recent survey of high school, university, and post-graduate athletes, we were surprised to find that many nutritional practices are still widely used that contribute nothing to the athlete's efforts. These practices simply reflect the lack of education and objectivity that is associated with sports nutrition.

This guide takes an objective look at the athlete's nutrient needs and presents recent findings from physiological and nutritional research which have direct bearing on athletic performance. It offers some new ideas that will help you prepare your athletes nutritionally to perform nearer their potential.

David L. Costill, Ph.D.
Director, Human Performance Laboratory
Ball State University

The U.S. Olympic Committee has supplied **FOOD POWER** to Olympic hopefuls at the Olympic Training Center in Colorado Springs, Colorado.

CONTENTS

ON SPECIFIC SPORTS 1

BASICS 8
Protein 8
Fat 8
Carbohydrate 9
Vitamins 9
Minerals 9
Water 10
Four Food Groups 10

WATER 11
Sweating 11
Dehydration 12
Rehydration 12

FUELS FOR SPORTS 14
Carbohydrate 14
Fat 14
Protein 14
Intensity, Duration and Frequency of Exercise 14

FOOD FOR ATHLETES 16
Training Diet 16
Pre-Competition Meals 18
Carbohydrate Loading 19

BODY COMPOSITION 21
Skinfolds 22
Circumferences 23
Body Fat 26
Muscle Growth 26

WEIGHT CONTROL 27
Energy Output 27
Energy Intake 28
Weight Maintenance 28
Weight Loss 28
Making Weight 28
Weight Gain 29

SPORTS MISINFORMATION 30
Muscle-Building Myths 30
Quick-Energy Myths 30
Performance Myths 31

APPENDIX 32
Appendix A/ Comprehensive List of Foods 32
Appendix B/ Recommended Daily Dietary Allowances 35
Appendix C/ Sources for Skinfold Calipers 36

GLOSSARY 36

0140N © 1984 Copyright © 1983

ON SPECIFIC SPORTS

FOOD POWER has seven chapters and 12 handouts on topics related to nutrition and sports. Many of these are important to the performance of all athletes, while others are of particular interest to athletes in specific sports. The following directory can help you find the chapters and handouts that are of particular importance to your sport.

BASEBALL

When spring training starts, are your players in top condition? Overfat players have to work harder to cover the outfield or round the bases. All baseball players require energy for quick bursts of activity—whether stealing bases or fielding ground balls. Playing in the sun can dehydrate players at all positions—even the bench.

Chapters in Coach's Guide

- Body Composition (p. 21)
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes

- How to Measure Your Body Fat – Men or Women
- How to Lose Weight
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water

BASKETBALL

Does your star center have the stamina to last the entire game? Any of your players—whether offense or defense—can burn out their energy stores long before they have foul trouble. An overfat guard must work harder to cover the boards.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)
- Body Composition (p. 21)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water
- How to Measure Your Body Fat—Men or Women

BICYCLING

Long-distance cyclists need both mental and physical toughness to endure their grueling events. They also need lots of energy to fuel the long hours of cycling. Whether competing or training, cyclists can lose enough water to compromise their performance.

Chapters in Coach's Guide
- Fuels for Sports (p. 14)
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water
- How to Carbohydrate Load

BOWLING

Skill, technique, and practice are essential to high scores. However, excess body fat can slow down even your most talented bowlers. Although relatively low in intensity, several hours of practice or competition, especially in warm facilities, can cause a loss of body water.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Water (p. 11)

Handouts for Athletes
- How To Measure Your Body Fat—Men or Women
- What You Need to Know about Water

BOXING

Long hours of practice can cause large losses of water and use up energy stores. To go the distance, a boxer needs a lean body and plenty of stamina. So excess fat should be shed, and muscle developed in its place.

Chapters in Coach's Guide
- Water (p. 11)
- Food for Athletes (p. 16)
- Body Composition (p. 21)

Handouts for Athletes
- What You Need to Know about Water
- What You Need to Know about a Training Diet
- How to Measure Your Body Fat—Men or Women
- How to Lose Weight
- How to Build Muscles

BICYCLING

BASKETBALL

BOXING

BOWLING

FIELD HOCKEY

Long hours of practice can burn up essential energy stores. Intense heat and hard workouts can cause large losses of body water and make players susceptible to heat injuries.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about a Training Diet
- What You Need to Know about Water

FIGURE SKATING

High-intensity routines last only a few minutes, but they can deplete your skaters' energy stores. Long hours of practice, especially at unusual times of the day, interfere with regular meals and can subject a skater to injury. Excess fat can limit the height of a skater's jumps or just add extra work to every movement.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Body Composition (p. 21)
- Weight Control (p. 27)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- How to Measure Your Body Fat—Men or Women
- How to Lose Weight

FOOTBALL

Training, especially during the hot pre-season, can drain all the players' energy and water stores. Bulking up may seem like a good idea, but not if it's excess fat. Whether a wide receiver or a defensive lineman, a player needs the strength and energy to fill the position.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)
- Body Composition (p. 21)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water
- How to Measure Your Body Fat—Men or Women
- How to Build Muscles

GOLF

Although skill, coordination, and practice are essential to low scores, your golfers must be able to adapt to intense heat and long hours. The heat can take its toll by drying out a golfer. And the long hours can sap his or her energy stores.

Chapters in Coach's Guide
- Water (p. 11)
- Food for Athletes (p. 16)

Handouts for Athletes
- What You Need to Know about Water
- What You Need to Know about Pre-Competition Meals

FIELD HOCKEY

FOOTBALL

GYMNASTICS/ TUMBLING

Lean, flexible bodies are the key to top performance. Excess fat can lead to disappointing scores and perhaps injury. Short bursts of quick energy are required whether for vaulting or completing a floor exercise.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Weight Control (p. 27)
- Food for Athletes (p. 16)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- How to Lose Weight
- What You Need to Know about Pre-Competition Meals

ICE HOCKEY

Extra fat may be helpful in body checking, but that excess weight can slow a hockey player down. Muscle is essential to strength, speed, and endurance. In addition, long hours on the ice can use up energy stores.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Weight Control (p. 27)
- Food for Athletes (p. 16)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- How to Lose Weight
- How to Build Muscles
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals

JOGGING

Recreational joggers can lose lots of water, especially during hot weather. Although the regular exercise can benefit the heart, it may drain the energy stores. Excess weight can be lost through a well-planned diet and exercise program.

Chapters in Coach's Guide
- Water (p. 11)
- Food for Athletes (p. 16)
- Weight Control (p. 27)

Handouts for Athletes
- What You Need to Know about Water
- What You Need to Know about a Training Diet
- How to Lose Weight

ROWING/CREW

Excess fat may have to be shed to "make weight" for the season. Some events can place severe demands on the athletes' energy stores. And training can deplete both water and energy reserves.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Weight Control (p. 27)
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- How to Lose Weight
- What You Need to Know about a Training Diet
- How to Carbohydrate Load
- What You Need to Know about Water

ICE HOCKEY

GYMNASTICS/TUMBLING

JOGGING

ROWING/CREW

RUNNING
(Cross-Country)

The demands of training and competition can drain your runners' energy stores. All runners, especially long-distance runners, need to replace the energy used daily. Water losses can be severe, especially in warm weather.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water

SKIING
(Cross-Country)

A few hours of cross-country skiing can drain the energy stores of your skiers. Dehydration can be a serious problem when a hard workout interferes with the need to stay warm. Extra energy stores are essential for training and racing.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water

SKIING
(Downhill)

Whether your skiers are competitive or recreational, a day of downhill runs can burn up the energy stores needed for quick turns and long runs. And dry air can rapidly dehydrate a skier, especially at high altitudes.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water

SOCCER

Soccer players require great endurance—both mentally and physically. The energy stores can be depleted from the constant running up and down the field. Replenishing energy stores is essential, especially after days of training. Competition during hot weather takes its toll on your players and heat injury is a serious consequence.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- How to Carbohydrate Load
- What You Need to Know about Water

SPEED SKATING

Whether your skaters are in the 1000-meter or 5000-meter race, their training and competition can deplete their energy stores. Excess fat can slow down the speedster.

Chapters in Coach's Guide
- Food for Athletes (p. 16)
- Body Composition (p. 21)
- Weight Control (p. 27)

Handouts for Athletes
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- How to Measure Your Body Fat—Men or Women
- How to Lose Weight

SQUASH/ RACQUETBALL

Games played in warm rooms can lead to dehydration and heat injury. Players also burn up their energy stores quickly with intense competition. Tournaments can put a severe strain on these energy stores.

Chapters in Coach's Guide
- Water (p. 11)
- Food for Athletes (p. 16)

Handouts for Athletes
- What You Need to Know about Water
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals

SWIMMING

Quick energy is essential to your sprinters and divers. They get that energy from the meals they eat days before competition—not from a lick of honey or a candy bar before the meet. Middle- and long-distance swimmers need plenty of energy to maintain their pace throughout their events.

Chapters in Coach's Guide
- Fuels for Sports (p. 14)
- Food for Athletes (p. 16)

Handouts for Athletes
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about a Training Diet
- How to Carbohydrate Load

TENNIS

Players are easy targets for heat injury—whether outdoors in the summer heat or indoors year-round. Players also burn up their energy stores during long hours of training and competition. Matches lasting two or more hours put a severe strain on these energy supplies.

Chapters in Coach's Guide
- Water (p. 11)
- Food for Athletes (p. 16)

Handouts for Athletes
- What You Need to Know about Water
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- How to Carbohydrate Load

SPEED SKATING

TENNIS

TRACK AND FIELD

Lean bodies are essential to most events – whether putting shot or pole vaulting. And excess fat means extra work – just to carry around the weight. Although each event has its own demands, quick bursts of energy are generally the rule – from sprinters to high jumpers.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Food for Athletes (p. 16)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- What You Need to Know about Pre-Competition Meals

VOLLEYBALL

Spiking the ball or just setting it up requires a short burst of energy. But an entire game or two can use up these energy stores. Also a hot room or hot weather can take its toll on players' water stores and can lead to heat injury if neglected.

Chapters in Coach's Guide
- Fuels for Sports (p. 14)
- Food for Athletes (p. 16)
- Water (p. 11)

Handouts for Athletes
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Water

WEIGHT LIFTING

Weight lifters need as much strength as possible – and that means muscle. Lifting, itself, stimulates the muscles to grow – not protein supplements or drugs. Pumping iron uses short bursts of energy, but many reps can empty the energy stores.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Food for Athletes (p. 16)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- How to Build Muscles
- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals

WRESTLING

Wrestlers should "make weight" by losing excess fat, not by losing essential body fluids. Rapid weight loss through starvation may break down muscle and dehydration decreases body water, which can lead to heat injury. These, in turn, decrease both strength and performance.

Chapters in Coach's Guide
- Body Composition (p. 21)
- Weight Control (p. 27)
- Water (p. 11)

Handouts for Athletes
- How to Measure Your Body Fat – Men or Women
- How to Lose Weight
- What You Need to Know about Water

VOLLEYBALL

WRESTLING

TRACK AND FIELD

WEIGHT LIFTING

Athletes need 50 or so nutrients to achieve their peak performance.

KEY POINTS

- Protein helps build and repair every cell in the body.
- Fat is a concentrated dietary source of energy and it carries vitamins A, D, E, and K.
- Carbohydrate is the main source of energy for the red blood cells and central nervous system and for muscles during exercise.
- Vitamins are essential nutrients that promote growth, maintain health, and regulate body processes.
- Minerals are compounds that give strength or rigidity to the body structure and help control body processes.
- Water makes up about 60 percent of body weight.

BACKGROUND INFORMATION

Protein, fat, carbohydrate, vitamins, minerals, and water are the six major classes of nutrients. These nutrients are chemical substances obtained from foods during digestion. They work together to supply athletes with energy, to build and maintain body cells, and to regulate body processes.

Energy (or calories) is supplied by carbohydrate, fat, and protein. Vitamins, minerals, and water do not supply energy. Carbohydrate and protein provide about half the energy that fat provides.

Carbohydrate	4 Calories per gram
Protein	4 Calories per gram
Fat	9 Calories per gram

WHAT IS PROTEIN?

Protein is found throughout the body. It is necessary to build all body cells. Since cells are being replaced continually, protein is needed throughout life.

Protein is required:

- To maintain and repair body tissues;
- To make hemoglobin, which carries oxygen to the cells;
- To form antibodies in the bloodstream that fight off infection and disease;
- To produce enzymes and hormones that regulate body processes; and
- To supply energy, if necessary.

Protein is made up of amino acids. When protein foods are digested, these amino acids are absorbed and used to form muscle, hemoglobin, enzymes, and hormones. Amino acids that are not used to form these compounds are broken down and stored as body fat.

The nutrient most frequently associated with athletic prowess is protein. Athletes of ancient times emphasized a high-protein diet—they felt that, to have the strength and power of a bull, they must consume his muscles. Over the past 100 years, many have argued in favor of feeding diets rich in protein to those involved in heavy training. Although protein provides the basic building blocks for the body tissues, research has not shown that megadoses of protein will increase muscle tissue growth during training. Nor does protein make a significant contribution to the energy needs of the athlete.

PROTEIN NEEDS VARY

The recommended daily protein allowances for healthy people in the United States are listed in Appendix B, p. 35. These allowances meet the needs of all healthy individuals in the population, including athletes. On a per weight basis, 0.8 gram of protein per kilogram (or 0.4 gram per pound) is recommended for young adults per day. For example, the recommendation for a 17-year-old male athlete who weighs 145 pounds is 56 grams of protein per day. In terms of food, one quart of milk and a hamburger on a bun would supply about 58 grams of protein—or enough to meet the protein allowance of this growing athlete.

The typical American diet supplies more than adequate amounts of protein for growth, including muscle development. Any excess protein is broken down and stored as body fat.

See page 26 for more information about protein and muscle building.

WHY FAT?

Fat is a concentrated source of energy from food. It provides more than twice as much energy as protein and carbohydrate. It supplies essential fatty acids and it carries vitamins A, D, E, and K. Fat is also part of cell walls.

During digestion, dietary fats are broken down into fatty acids. Body cells, except red blood cells and those of the central nervous system, can use fatty acids directly as a source of energy. Any fatty acids not used as energy are stored as body fat.

See page 14 for more information about fat as a fuel for sports.

WHAT DOES CARBOHYDRATE DO?

Carbohydrate is the main source of energy for the red blood cells and central nervous system. Carbohydrate spares protein from being used for energy. And it aids in the use of fat.

Sugars and starches are the chief kinds of carbohydrate. They are broken down during digestion into glucose. It is glucose that is used as energy for the red blood cells and the central nervous system. Glucose is also the primary source of energy for the muscles during exercise. Glucose not used immediately for energy is stored in the liver and muscles as glycogen (a long chain of glucose molecules). Any glucose that is not used as energy or converted to glycogen is changed to fatty acids and stored as body fat.

See pages 14-15 for more information about carbohydrate as a fuel for sports.

ARE VITAMINS IMPORTANT?

Vitamins help control the growth of all body tissues. They are also essential for the release of energy in the body. While each vitamin's role in maintaining normal cell operations is important, very small amounts of each vitamin are needed to accomplish this.

Although deficiencies of vitamins can impair physical performance, there is no evidence that vitamins taken in excess of the normal daily requirements will enhance performance.

The recommended daily allowances for vitamins are listed in Appendix B, p. 35. These amounts meet the needs of all healthy individuals, including athletes.

Vitamins are widely distributed in the foods that make up the typical diet. Most athletes can obtain all essential vitamins they need by eating a wide variety of foods from the Four Food Groups (Milk, Meat, Fruit-Vegetable, Grain).

SHOULD ATHLETES TAKE SUPPLEMENTS?

Athletes who habitually eat inadequate diets may require specific vitamin supplements. However, a physician should be the one to identify the need for supplements and prescribe and supervise their use.

Vitamin supplementation is a common practice among athletes seeking to improve their performance. However, if athletes take large doses (megadoses) of vitamins as supplements, they may be harming themselves rather than helping.

Excessive amounts of fat-soluble vitamins, like vitamins A and D, may be hazardous. Excesses of these are dissolved in fat and stored in the body. Vitamin A and D excesses can lead to growth retardation and permanent damage to organs and other tissues.

Some have claimed that vitamin C can cure or prevent diseases. This has not been scientifically proven. Extra vitamin C and the other water-soluble vitamins are excreted in the urine. So the money spent on "improving performance" is just flushed down the drain.

WHAT DO VITAMINS DO?

The following list identifies some of the vitamin functions.

FAT-SOLUBLE VITAMINS

VITAMIN A
- Maintains eye and skin health
- Aids resistance to infection

VITAMIN D
- Aids absorption of calcium

VITAMIN E
- Protects vitamins and essential fatty acids from destruction

VITAMIN K
- Needed for blood clotting

WATER-SOLUBLE VITAMINS

VITAMIN C
- Strengthens body cells
- Promotes healing of wounds and bones
- Increases resistance to infections

THIAMIN (VITAMIN B_1)
- Used in carbohydrate metabolism
- Promotes normal appetite

RIBOFLAVIN (VITAMIN B_2)
- Used in energy metabolism
- Promotes good vision and healthy skin

NIACIN
- Used in fat and carbohydrate metabolism
- Promotes healthy skin, nerves, and digestive tract

VITAMIN B_6
- Used in protein and fatty acid metabolism
- Needed for red blood cell formation

FOLACIN (FOLIC ACID)
- Used in protein metabolism
- Promotes red blood cell formation

VITAMIN B_{12}
- Used in energy metabolism
- Assists in red blood cell development
- Assists in maintenance of nerve tissue

WHAT ARE MINERALS?

Minerals are important for body structure and for controlling body processes. Recommended allowances have been established for six minerals — calcium, phosphorus, iodine, iron, magnesium, and zinc. These allowances are listed in Appendix B, p. 35.

- Calcium is used to form bones and teeth. About 99 percent of the calcium in the body is found in the skeleton. The other one percent helps control body processes — clotting blood and contracting and relaxing muscles.
- Phosphorus combines with calcium to give bones and teeth strength and hardness.
- Iodine helps regulate the rate at which the body uses energy.
- Iron is an important part of hemoglobin which carries oxygen throughout the body. Without enough iron, hemoglobin cannot deliver the oxygen athletes need. When the cells don't get enough oxygen and carbon dioxide is not carried away, fatigue may result. Thus, a lack of iron may be one cause of fatigue.

Note: Iron-deficiency is more common in females than in males. Iron losses during menstruation are often not replaced by the diet, especially a low-calorie diet. Special attention should be paid to female athletes and the iron content of their diets.

- Magnesium helps regulate the use of carbohydrate and the production of energy within the cells. It also helps the nerves and muscles work.
- Zinc becomes part of several enzymes which affect cell growth and repair and also part of insulin which is essential for the use of glucose in the blood.

Athletes who habitually eat inadequate diets may require specific mineral supplements. A physician should be consulted to identify a need and to prescribe and supervise any supplements.

WATER—AN ESSENTIAL NUTRIENT

Water is probably the nutrient most neglected by your athletes. In fact, many of them may not know it is a nutrient. About 60 percent of the body weight is water. Without water, athletes could not survive more than a few days. One of water's most important functions is as a coolant to keep the body from overheating during physical activity. A more detailed discussion of water begins on page 11.

HOW DO ATHLETES GET THE 50 OR SO NUTRIENTS THEY NEED?

By eating a wide variety of foods from the Four Food Groups, athletes should get all the nutrients they need. Ten of the known nutrients are considered "leader nutrients." That is, if athletes get adequate amounts of these nutrients from their food daily, the other 40 or so will probably be obtained, too. The 10 leader nutrients are protein, carbohydrate, fat, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron.

The Four Food Groups were developed using these leader nutrients. For example, the Milk Group includes foods which are good sources of calcium, riboflavin, and protein. And the Fruit-Vegetable Group includes vitamin A- and vitamin C-rich foods.

No single food or food group supplies all the nutrients an athlete needs. So it is important that athletes choose a variety of foods from each food group. If they eat at least the recommended servings from each food group daily and choose a variety of foods, athletes can be assured that they are getting the nutrients they need for optimal performance.

FOUR FOOD GROUPS

MILK Group	MEAT Group	FRUIT-VEGETABLE Group	GRAIN Group
2 Servings/Adults 4 Servings/Teenagers	2 Servings	4 Servings	4 Servings
Calcium Riboflavin (B_2) Protein	Protein Niacin Iron Thiamin (B_1)	Vitamin A Vitamin C	Carbohydrate Thiamin (B_1) Iron Niacin

WATER

Water is a very important nutrient for athletes. It is the major part of sweat which helps athletes cool down during exercise.

KEY POINTS

- Cool, plain water should be provided before, during, and after practice and competition.
- Athletes should drink 1-1½ cups of water 15 minutes before practice or competition.
- Encourage athletes to drink ½ cup of water every 10-15 minutes during practice or competition.
- Weigh each athlete before and after practice and competition—especially during hot weather. For each pound of weight lost, an athlete should drink two cups of water.
- Limit the use of sport drinks and soft drinks to replace water lost as sweat.
- For rapid replacement of water, a drink should be:
  —Cold (roughly 40-50° F),
  —Low in sugar (less than ½ teaspoon in ½ cup of water), and
  —Consumed frequently and in moderate amounts (½ cup every 10-15 minutes).

BACKGROUND INFORMATION

About 60 percent of body weight is water. Water functions in the body as:

- A solvent in digestion, where it helps the chewing and softening of food;
- A solvent for elimination of waste products;
- A major portion of the blood;
- A lubricant in such places as the joints and between internal organs; and
- A coolant for the body.

The most important function of water that athletes should remember is that it cools the body. During exercise heat is generated within the body as a by-product of the working muscles. This heat must be removed to maintain a normal body temperature. When heat builds up, the body temperature rises and performance suffers.

Sweating is the body's mechanism for getting rid of this excess heat. When sweat evaporates from the skin, the body cools down. Heavy sweating, however, reduces the body's water content. And large losses of body water can diminish the athlete's capacity to perform and can lead to heat injury.

WHAT FACTORS CAN AFFECT SWEATING?

Exercise during **hot, humid weather** can lead to heat injury more quickly than exercise during cool, dry (or even hot, dry) weather. When the humidity is high, sweat does not evaporate readily. When the sweat does not evaporate, heat builds up in the body and performance suffers. So if an athlete has sweat "pouring" and "dripping" from his or her skin, he or she may be missing the benefit of sweat—cooling down.

To prevent problems with heat and humidity, have athletes exercise at the coolest time of the day. Avoid practice during the middle of the day when the temperature is usually the highest. If you must have them practice or compete then, gradually build up their tolerance to heat. To do this, hold workouts for a short time each day and increase the length of each workout gradually.

In the past, some have tried restricting fluids during practice so that the athlete won't be dependent on them during competition. However, water is essential for many body functions. And water restriction during training will **not** make athletes better suited to exercise. In other words, the body can't adapt to being dehydrated. The athlete will always perform better when fluids, especially water, are consumed to offset those lost during heavy sweating. Athletes who lose large amounts of body water risk overheating and place unusual stress on their hearts and cardiovascular systems.

Although sweat evaporates very quickly in hot, dry air, these conditions can also lead to heat problems in athletes. When sweat evaporates from the skin and cools the body down, large amounts of water are lost. Since they don't feel sweaty, athletes may not recognize that they have lost a large amount of water. If they don't drink water and replace what they've lost, they can become dehydrated and develop heat problems.

Clothing and sports gear can also affect sweating. Heavy sweat suits, equipment, and other gear trap sweat and prevent its evaporation. This results in a build up of body heat. Therefore, in hot weather, athletes should wear the lightest clothing and equipment possible. Mesh jerseys, lightweight shorts, and low-cut socks allow more sweat to evaporate than sweat suits and heavy gear.

Exercise in cold weather poses two heat-related problems. Athletes need to keep the body warm, but they also need to allow the body to sweat. When exercising in cold weather, athletes should wear several layers of loose clothing. By wearing layers, the warmth from the body is trapped, but the sweat can be absorbed by the clothing. Also, as athletes warm up, they can remove a layer or two and avoid overheating.

HOW CAN DEHYDRATION AND HEAT AFFECT AN ATHLETE'S PERFORMANCE?

Excess heat can lead to heavy sweating, which can then lead to dehydration. Symptoms can become severe if nothing is done to prevent or treat the problem. If you ignore the athlete's thirst or limit the amount of water he or she can drink, the following forms of heat illness may occur: heat cramps, heat exhaustion, and heat stroke.

HEAT CRAMPS

Working out in hot weather or in a hot room can lead to profuse sweating. The first symptoms of this state of dehydration include thirst, chills, clammy skin, throbbing heart beat, and nausea. The loss of large amounts of water can also cause muscle pain and spasms.

Treatment: Cool, plain water should be available and athletes should be encouraged to drink ½ cup every 10-15 minutes. During breaks have athletes move to a cool or shaded area and remove as much clothing as possible.

HEAT EXHAUSTION

You may see cases of heat exhaustion in athletes who are not well-conditioned, especially during the first hard workout of the season on a hot day. Heat exhaustion has dramatic effects – reduced sweating; shortness of breath; dryness in the mouth; a weak, rapid pulse; headache; dizziness; and extreme fatigue. At this point, the body temperature is normal.

Treatment: The athlete should stop exercising, move to a cool environment, and place an ice bag on his or her head. Have the athlete take off wet clothing and sit on a chair in a cold shower. Have the athlete drink two cups of cool, plain water for every pound lost.

HEAT STROKE

This is a medical emergency! The athlete's body temperature is excessively high (sometimes as high as 105°F). Symptoms include lack of sweat; dry, hot skin; visual problems; deafness; swollen tongue; nervousness; hallucinations; aggression; and unsteady walking. The athlete may collapse, lose consciousness, and convulse. Immediate medical attention is necessary.

Treatment: Call for emergency medical treatment (and send someone with the athlete). Until medical help arrives, you should try to lower the athlete's elevated body temperature. You can do this by: placing ice bags on the back and front of the head; removing clothing and rubbing alcohol over most of the body; putting the athlete on a chair in a cold shower. Death can occur if you do not act quickly.

HOW CAN YOU PREVENT DEHYDRATION?

To prevent dehydration, simply have athletes **drink fluids**. They should drink two cups of water for every pound lost as sweat. However, some athletes try bizarre and dangerous techniques to voluntarily dehydrate to "make weight." Others involuntarily dehydrate during long periods of heavy sweating, such as during a football game or a marathon. No matter how athletes become dehydrated, the only way to prevent dehydration and its effects is to have them drink enough water to replace that lost as sweat.

Unfortunately, our drive to replace body fluids is far less effective than that in other animals. One study observed that, after walking eight hours in the desert, a burro lost about 40 pounds of water (5 gallons). When placed on a freight scale next to a watering trough, the burro drank continuously for 5-6 minutes, until it replaced all of its water losses.

On the other hand, a man who sweats away 3 to 4 quarts (6 to 8 pounds) of body water experiences a temporary thirst that is satisfied after drinking only a pint of fluid. It would take the man's thirst about 12 to 24 hours to register a need for all 3-4 quarts of water lost.

You can't depend on your athletes to voluntarily drink enough to replace all the sweat they lose, because thirst is not a good indicator of how much water is needed.

A good rule of thumb is that for each pound of weight lost as sweat, athletes should drink two cups of water. Weighing the athletes before and after practice and competition is a way to determine the amount of water needed.

FACTORS WHICH AFFECT REHYDRATION

To rehydrate an athlete, fluids must be absorbed as quickly as possible. Three factors affect how fast fluids leave the stomach and are absorbed: volume, temperature, and sugar content.

VOLUME

Large amounts of fluids (up to 20 ounces or 2½ cups) empty more quickly from the stomach than small amounts. Athletes, however, may find it uncomfortable to exercise with a full stomach. If they drink ½ cup of water every 10-15 minutes, athletes will get the fluid they need without a "bloated" feeling.

TEMPERATURE

Cold drinks (40-50°F) leave the stomach more rapidly than warm fluids. Cold solutions lower the temperature of the stomach which causes the stomach to empty more rapidly. (Cold drinks also help an overheated athlete cool down.) Even ice cold drinks should not cause stomach cramps, regardless of the volume.

SUGAR CONTENT

Sugars (glucose, fructose, or sucrose) slow the rate that fluids leave the stomach. For example, if one of your athletes drinks 12 ounces of plain water, only 30 percent of the water will still be in the stomach 15 minutes later. If that same athlete drinks 12 ounces of a soft drink, 100 percent of the drink will be in the stomach 15 minutes later. So drinking a strong sugar drink is a poor method of replacing water lost as sweat. Only very dilute sugar drinks can deliver the water needed.

It's been found that the sugar content of sport drinks should not exceed 2 to 2½ grams per 100 ml. That's about ½ teaspoon of sugar in ½ cup water. Most commercial sport drinks have two to three times that amount of sugar. If your athletes use sport drinks, they should be diluted at least 50 percent – ½ cup sport drink plus ½ cup water.

DO YOUR ATHLETES NEED MORE THAN WATER?

Sweat is not much more than plain water. Very small amounts of the minerals sodium, potassium, and mag-

nesium are present in sweat. So during heavy sweating, athletes lose more body water than minerals. For example, a 128-pound athlete might lose four pounds of sweat during practice. That's about five percent of the body's water. Along with that, the athlete would sweat away: only 4 percent of the body's sodium, less than ½ percent of its potassium, and less than ½ percent of its magnesium. These small amounts of minerals can easily be replaced by foods in the athlete's next meal.

The kidneys also work to control the body's water and mineral content. When an athlete is dehydrated, the kidneys cut back the urine production. They also conserve minerals. Thus, there is little danger of a shortage of sodium, potassium, or magnesium.

Although manufacturers of sport drinks advertise that their products replace sweat, the most important part of these beverages is the water. And cool, plain water is a much better and cheaper replacement for water lost as sweat.

WILL SPORT DRINKS HURT YOUR ATHLETES' PERFORMANCE?

Because they must stay in the stomach until diluted, sport drinks could possibly hurt the athlete's performance. The longer a fluid stays in the stomach, the longer it takes for the water to get where it's needed. In the meantime, the athlete can become overheated. As mentioned earlier, if athletes use sport drinks, they should be diluted at least 50 percent—½ cup sport drink plus ½ cup plain water.

DO SALT TABLETS REPLACE SWEAT LOSSES?

Sweat is really very dilute—it has only a small amount of salt. Salt tablets are unnecessary since normal meals replace the salt lost in sweat. In addition, salt tablets can be harmful. They can irritate the stomach lining and can cause nausea and vomiting. They also draw more water into the stomach from other body tissues, which can make an existing dehydration problem worse.

GUIDELINES FOR REPLACING WATER

- Drink cool, plain water before, during, and after practice and competition.
- To avoid dehydration, drink 1-1½ cups of water 15 minutes before practice and competition. And drink ½ cup water every 10-15 minutes during practice or competition.
- After practice or competition, replace every pound of weight lost as sweat with 2 cups of water.

To help your athletes understand the importance of water, use the handout:
- What You Need to Know about Water

SIGNS TO LOOK OUT FOR

If your athletes have any of the symptoms below, they may be developing a heat injury. Watch for these symptoms and be prepared to take appropriate actions to correct them.

	SYMPTOMS	WEIGHT LOSS	TREATMENT
HEAT CRAMPS	■ Thirst ■ Chills ■ Clammy skin ■ Throbbing heart beat ■ Nausea	A loss of up to 5 percent of body weight as sweat. ■ up to 5 pounds for 100-pound athlete ■ up to 7½ pounds for 150-pound athlete ■ up to 10 pounds for 200-pound athlete	Athlete should: ■ Drink ½ cup of water every 10-15 minutes ■ During breaks, move to shade and remove as much clothing as possible
HEAT EXHAUSTION	■ Reduced sweating ■ Dizziness ■ Headache ■ Shortness of breath ■ Weak, rapid pulse ■ Lack of saliva ■ Extreme fatigue	A loss of 5-10 percent of body weight as sweat. ■ 5-10 pounds for 100-pound athlete ■ 7½-15 pounds for 150-pound athlete ■ 10-20 pounds for 200-pound athlete	Athlete should: ■ Stop exercise and move to a cool environment ■ Drink 2 cups of water for every pound lost ■ Take off wet clothing and sit on a chair in a cold shower ■ Place an ice bag on his or her head
HEAT STROKE	■ Lack of sweat ■ Dry, hot skin ■ Lack of urine ■ Hallucinations ■ Swollen tongue ■ Deafness ■ Visual disturbances ■ Aggression ■ Unsteady walking ■ Excessively high body temperature	A loss of over 10 percent of body weight as sweat. ■ over 10 pounds for 100-pound athlete ■ over 15 pounds for 150-pound athlete ■ over 20 pounds for 200-pound athlete	You should: ■ Call for emergency medical treatment ■ Until help arrives, place ice bags on back and front of athlete's head ■ Remove clothing and rub alcohol over most of the athlete's body ■ Put athlete on chair in cold shower

FUELS FOR SPORTS

Carbohydrate is the chief form of energy for athletes.

KEY POINTS

- High-carbohydrate foods—such as breads, cereals, pastas, fruits, and vegetables—supply glucose.
- Glucose can be stored in the liver and muscles as glycogen.
- Athletes use carbohydrate (glucose and glycogen) for energy needed during exercise.
- Fats can also serve as a source of energy.
- Protein foods can be broken down to supply glucose, if necessary.
- The intensity, duration, and frequency of exercise affect the type and amount of energy burned.

BACKGROUND INFORMATION

Carbohydrate, protein, and fat are the three energy nutrients. All three can provide energy, but carbohydrate is the chief form of energy for physical activity.

CARBOHYDRATE

Athletes get most of the energy for exercise from carbohydrate. Glucose (a simple sugar) and glycogen (a long chain of glucose molecules) are the forms of carbohydrate used.

High-carbohydrate foods—such as breads, cereals, pastas, fruits, and vegetables—are excellent sources of glucose. If the glucose isn't used immediately as energy, it is converted to glycogen and stored in the liver and muscles.

Athletes draw on the stored glycogen for energy when needed. For example, during the first few minutes of any activity, glucose is the major source of fuel. After that, the body starts using its glycogen stores. Once the glycogen stores are used up, the athlete becomes exhausted.

FAT

Fat is also an energy source for athletes. They have stores of it just under the skin and some is stored within their muscles. But it takes 20 to 30 minutes from the time athletes start to exercise until enough fat is available to be of much help during exercise. Once more fat is burned, less glycogen is used. Since the glycogen stores are limited and fat stores are abundant, this can be a help to your athletes involved in endurance events. (See pages 19-20 for more information about endurance events.) However, fat is a less efficient source of energy because it requires more oxygen to burn.

PROTEIN

It is possible to use protein for energy, but that's one of its least important functions in the body. Only during starvation or extreme malnutrition does the body use protein as a direct source of fuel. (See page 8 for more information about protein.)

WHAT FUELS DOES THE BODY BURN DURING EXERCISE?

Athletes burn different amounts of carbohydrate and fat depending on the intensity, duration, and frequency of the exercise.

Based on intensity and duration, exercise can be separated into two types—anaerobic and aerobic. Anaerobic exercise means that the muscles can't get all the oxygen they need. Or, in other words, the muscles perform without using oxygen. Anaerobic exercises are usually high-intensity and short-duration events like the 200-yard dash, 50-yard swim, and weight lifting. Football, baseball, volleyball, and field events are also anaerobic—using a quick burst of energy for a short period of time. In all these sports, athletes burn glycogen primarily. Even though the bursts of activity in these sports don't last long, when strung together they can exhaust the glycogen stores.

The body has only a limited supply of glycogen. About 375 grams of glycogen are normally stored in the liver and muscles. This amounts to about 1400 Calories. If athletes were able to use all of this carbohydrate during an endurance event, they would have enough to last about two hours.

Aerobic exercises are low and moderate in intensity and long in duration—like marathon running, distance swimming, cycling, recreational jogging, and hiking. In these, the muscles get most of the oxygen they need. And about 70 percent of the fuel comes from glycogen, while the rest is from fat.

Some activities, like basketball, swimming, and middle-distance running, are intense but are performed for 5-10 minutes. In these activities, glycogen is also the primary fuel.

The frequency of the activity also affects the fuels burned. Hard, physical training day after day can use up all the glycogen in the muscles. Each muscle has only a limited store of glycogen. And when that's gone, athletes cannot exercise. Poor performance is often blamed on a "bad day." It may really be caused by low levels of glycogen in the muscles.

As you know, different activities use a different set of specific muscles. Each of these muscles stores glycogen. In addition, there are different types of muscle fibers used in specific types of activities. The two muscle fiber types are slow-twitch and fast-twitch. Slow-twitch fibers have good endurance, while the fast-twitch fibers seem best suited for explosive, sprint-type events.

Although each type of muscle fiber stores glycogen, the glycogen does not easily move between these fibers. For example, after an hour of continuous exercise, an athlete's slow-twitch fibers may be almost completely emptied of glycogen. However, the fast-twitch fibers may be almost full. Although the fast-twitch fibers can be recruited to continue the exercise, they are easily fatigued and cannot continue to do the work of the slow-twitch fibers for very long. Therefore, once athletes have used up the glycogen in the muscle fibers they must replace that glycogen.

HOW CAN YOU BE SURE ATHLETES HAVE THE FUEL FOR EXERCISE?

Eating high-carbohydrate foods supplies the muscles with glycogen. When athletes eat a normal diet (about 350 grams of carbohydrate a day), they don't quickly replace the glycogen used during hard training. A diet high in carbohydrate (550-650 grams of carbohydrate) restores exhausted muscles within 24 hours. (See pages 16-17 for more information on how glycogen stores can be refilled.)

Studies have been done to see if there are advantages to eating complex carbohydrate foods or starches (like spaghetti) over simple carbohydrate foods (like candy). They have found three advantages:

- Results show that, after 24 hours, athletes stored just as much glycogen with simple carbohydrate foods as with complex carbohydrate foods. On the second day, however, complex carbohydrate foods caused a slightly greater glycogen storage.
- Complex carbohydrate foods also produce less insulin response than simple carbohydrates. For example, a candy bar causes a sharp rise in the amount of insulin in the blood and the sugar in the blood is removed too quickly. Complex carbohydrate foods, such as breads or pasta, do not produce this sharp response.
- Complex carbohydrate foods contain other nutrients that athletes also need, such as the B vitamins. Most simple carbohydrate foods do not.

To help athletes understand the importance of carbohydrate, use the handouts:

- What You Need to Know about a Training Diet
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Food
- How to Carbohydrate Load

FOOD FOR ATHLETES

TRAINING DIET

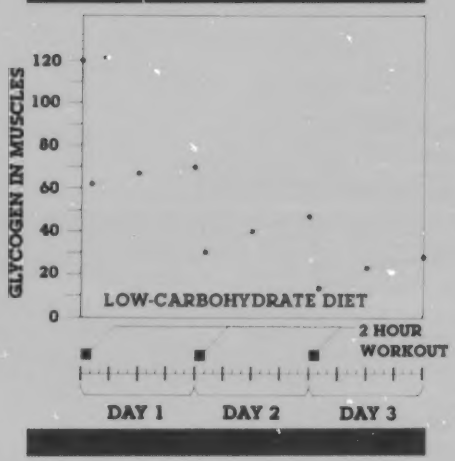
The athlete's diet must replace the glycogen used in training.

KEY POINTS

- Hard, physical training drains the stores of glycogen in athletes' muscles.
- If athletes don't replenish their glycogen stores adequately, chronic fatigue can set in.
- Athletes can replenish their glycogen stores by eating a diet high in carbohydrate.
- When helping athletes plan high-carbohydrate training diets, keep in mind that:
  - Cereals, breads, pasta, muffins, pancakes, rolls, and other grain products are good sources of carbohydrate.
  - Fruits and vegetables are also good sources.
  - Milk, yogurt, cocoa, ice milk, milkshakes, and ice cream all contain carbohydrate.
  - With the exception of dry beans and peas (like refried beans or blackeye peas), foods from the Meat Group are low in carbohydrate.
  - Cakes, pies, cookies, soft drinks, and other sugary foods from the "Others" Category are high in carbohydrate. However, they are low in most other nutrients.

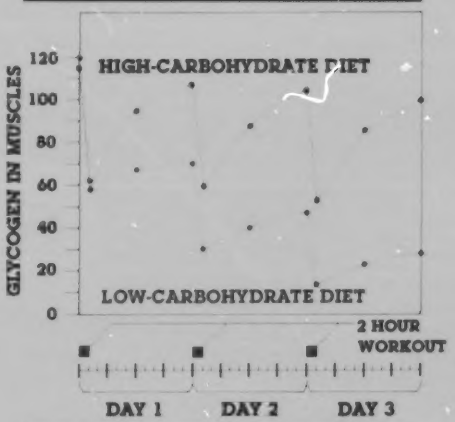
BACKGROUND INFORMATION

Hard, physical training—especially twice-a-day workouts—can use up most of the glycogen stored in athletes' muscles. The following chart illustrates glycogen levels in the muscles of an athlete on a low-carbohydrate diet after just three days of two-hour workouts.



In just three days of training, athletes can use most of the glycogen in their muscles. On a low-carbohydrate diet, the glycogen isn't replaced quickly enough. You may soon see the effects of chronic fatigue—reduced speed, precision, and endurance.

On a high-carbohydrate diet, athletes can quickly replace the glycogen they use to almost the starting level. The next chart illustrates how a high-carbohydrate diet can replace the muscle glycogen during three days of training. If athletes eat enough carbohydrate, even muscles severely emptied of glycogen can be adequately refilled within 24 hours.



In the summer of 1972, Jack Wilmore (University of Arizona) and Dave Costill (Ball State University) spent several days doing research at the San Francisco 49er's football training camp. The players were training hard twice each day and showing signs of wear-and-tear. As these researchers watched the men go through the cafeteria line four to five times each day, they made note of the volumes of meat, eggs, and bacon consumed at every meal.

In retrospect, Costill and Wilmore now realize that at least part of the chronic fatigue they saw in those players may have been due to the lack of carbohydrate and the failure to store enough muscle glycogen. Costill has wondered how many good rookies are dropped from professional football training camps because they are overworked and lack the proper diets required for them to show their full talents.

HOW MUCH CARBOHYDRATE IS ENOUGH?

Studies have shown that athletes who eat a normal diet get about 350 grams of carbohydrate per day. This diet does not replace the muscle glycogen used up in training each day. On the other hand, eating a diet high in carbohydrate (about 550-650 grams per day) almost completely replaces the muscle glycogen within 24 hours.

Some foods high in carbohydrate are:

	Grams of carbohydrate
MILK GROUP	
Milkshake, chocolate, 10.6 oz	63
Yogurt, strawberry, 1 cup	42
Pudding, chocolate, ½ cup	30
Milk, chocolate, 1 cup	26
Cocoa, ½ cup	19
Ice cream, vanilla, ½ cup	16
Milk, lowfat and skim, 1 cup	12
Milk, whole, 1 cup	11
MEAT GROUP	
Refried beans, ½ cup	26
Blackeye peas, mature, ½ cup	17
FRUIT-VEGETABLE GROUP	
Raisins, 4 Tbsp	33
Potatoes, french fried, 20 pieces	31
Potato, baked, large	30
Applesauce, sweetened, ½ cup	30
Banana, medium	26
Peaches, canned in syrup, ½ cup	26
Pear, medium	25
Fruit salad, ½ cup	25
Pineapple, large slice	24
Grape juice, ½ cup	21
Apple, medium	20
Potatoes, boiled, 2 small	18
Potato, sweet, ½ medium	18
Beans, lima, ½ cup	17
Corn, ½ cup	16
Orange, medium	16
Squash, winter, ½ cup	14
Potatoes, mashed, ½ cup	13
Grapefruit, pink, ½ medium	13
Orange juice, ½ cup	13
Watermelon, 1 cup	13
GRAIN GROUP	
Cornbread, 2½" x 3"	30
Roll, hard	30
Bagel	28
Rice, ½ cup	25
Roll, hamburger or frankfurter	21
Noodles, egg, ½ cup	19
Waffles, 2	17
Cornflakes, ¾ cup	16
Hominy grits, ½ cup	14
Tortilla, corn, 6" diameter	14
Biscuit, baking powder	13
Bread, white, 1 slice	12
Oatmeal, ½ cup	12
Bread, whole wheat, 1 slice	11

There are a wide variety of foods in each of the Four Food Groups that can supply athletes with the carbohydrate needed to refill glycogen stores. To get 550-650 grams of carbohydrate each day, athletes should have at least the following number of servings from the Four Food Groups:

MILK GROUP
4 or more servings (teenagers)
2 or more servings (adults)

MEAT GROUP
2 or more servings

FRUIT-VEGETABLE GROUP
8 or more servings

GRAIN GROUP
8 or more servings

In addition, some foods from the "Others" Category – such as cakes, cookies, pies, soft drinks, and candy – can supply additional carbohydrate. However, these foods are low in most other nutrients. They should be eaten only after the recommended number of servings from the Four Food Groups have been obtained.

To help athletes understand the importance of the training diet, use the handouts:

- What You Need to Know about a Training Diet
- How to Select the Diet for You
- What You Need to Know about Food

High-carbohydrate foods should be eaten three to four hours before competition.

KEY POINTS

- It can take one to four hours for food to be processed by the stomach and emptied into the small intestine.
- Foods that are mainly carbohydrate, like grain products, fruits, and vegetables, take the least amount of time to digest.
- Foods that contain protein, like milk products and lean meats, take a little longer.
- Foods that are mainly fats, like mayonnaise, gravies, and salad dressings, take the longest to digest.
- A pre-competition meal of high-carbohydrate foods should be eaten by athletes three to four hours before the event.

BACKGROUND INFORMATION

The diet athletes eat two to three days before competition fills their muscles with glycogen. By the time athletes go to bed the night before competition, they have the glycogen stores they will compete with. So, what your athletes eat on the day of competition will not do much to increase the level of muscle glycogen.

WHAT'S THE PURPOSE OF THE PRE-COMPETITION MEAL?

The purpose of the pre-competition meal is to prevent hunger during competition. However, the stomach should not be full during the event. In general, it can take from one to four hours for the stomach to process a meal and empty it into the intestine. If athletes are a bit nervous about the competition, this process might proceed more slowly. Foods which remain in the stomach during competition may cause indigestion, nausea, and possibly vomiting. For safety's sake, advise athletes to eat their pre-competition meals three to four hours before competition. That way the stomach will be relatively empty during the event.

WHAT SHOULD ATHLETES AVOID IN THE PRE-COMPETITION MEAL?

High-fat, high-protein foods, such as meats (like steaks and hamburgers), and fried foods (like french fries and doughnuts) are not digested quickly. For that reason, they should be avoided or limited in the pre-competition meal.

Foods that contain a high percentage of carbohydrate are easily removed from the stomach. Then athletes won't be competing with food in their stomachs.

Keep these tips in mind when helping athletes plan their pre-competition meals:

- Cereals, breads, pasta, muffins, pancakes, rolls, and other grain products are good sources of carbohydrate.
- Fruits and vegetables are also good sources.
- Milk, yogurt, cocoa, ice milk, milkshakes, and ice cream all contain carbohydrate.
- With the exception of dry beans and peas (like refried beans or blackeye peas), foods from the Meat Group are low in carbohydrate and high in fat and protein.
- Cakes, pies, cookies, soft drinks, and other sugary foods from the "Others" Category are high in carbohydrate. Some are high in fat and low in most other nutrients.

WHAT'S A GOOD PRE-COMPETITION MEAL?

Some sample high-carbohydrate, pre-competition meals are outlined below. They contain plenty of carbohydrate and limit the amount of protein and fat.

		Protein g	Carbohydrate g	Fat g
Orange juice	1 cup	2	26	-
Cornflakes	¾ cup	2	16	-
Banana	1 med.	1	26	-
Wheat toast	2 slices	4	22	2
Jelly	1 Tbsp	0	13	0
Skim milk	1 cup	8	12	-
	Total	17	115	2
Vegetable soup	1 cup	2	13	2
Chicken	2 oz	6	0	3
White bread	2 slices	4	24	2
Applesauce	1 cup	-	30	-
Yogurt, lowfat	1 cup	9	42	3
	Total	21	109	10
Julienne salad made with				
Lettuce	1 cup	2	4	-
Ham	1 oz	9	0	3
Turkey	1 oz	9	0	2
Pudding	½ cup	4	30	4
Grape juice	1 cup	1	42	-
	Total	25	76	9
Pork and beans	1 cup	16	48	6
Crackers	10	2	20	4
Carrot sticks	5" carrot	1	5	-
Fruit salad	½ cup	2	25	1
Skim milk	1 cup	8	12	-
	Total	29	110	11

SHOULD ATHLETES EAT OR DRINK RIGHT BEFORE COMPETITION?

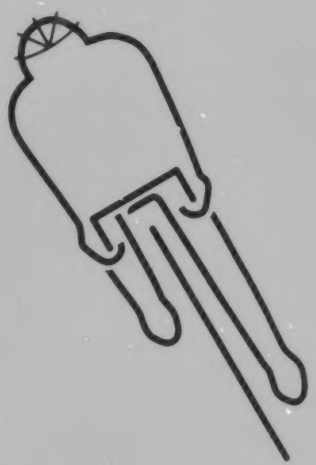
Foods and beverages (except water) should not be consumed an hour or less before competition. Eating foods, like candy, sugar, or chocolate, or drinking beverages, like soft drinks or sport drinks, within an hour of competition can be a big mistake. Every time athletes eat carbohydrate, insulin is released into their bloodstreams to help their bodies use the carbohydrate. This reaction has little effect when athletes are relatively inactive. But once the athletes start competing, their muscles become very sensitive to insulin and there is a decrease in blood sugar level. As a result, athletes will feel extremely fatigued and may not perform at their best. This condition is called hypoglycemia or low blood sugar.

A soft drink, sport drink, or candy bar taken 15 to 60 minutes before exercise can cause hypoglycemia. And once the blood glucose is reduced, athletes must use their muscle glycogen to meet their energy needs. This then uses up the muscle glycogen faster and can lead to fatigue or exhaustion. The only beverage that should be consumed within an hour of competition is water. (See page 11 for more information about water.)

A somewhat controversial study has tested the effects of coffee on performance. The results showed that coffee, when taken an hour before exercise, can improve **endurance performance.** The caffeine stimulates a greater use of fats for energy and, therefore, less glycogen is burned. The overtones of "drugging" have provoked recommendations to ban caffeine as an illegal drug for international competition. In addition, it is noted that roughly two out of every 10 users will not get any benefit from caffeine and may, in fact, get a negative, hypersensitive response. At **no** time should caffeine-containing tablets be used prior to or during exercise due to the misuse and possible overdose on caffeine.

To help athletes understand the importance of the pre-competition meal, use the handouts:
- What You Need to Know about Pre-Competition Meals
- What You Need to Know about Food

Athletes in endurance events can store two to three times the normal amount of glycogen in the muscles.



KEY POINTS

- Athletes in endurance events (continuous activity lasting 60 minutes or longer) need more glycogen for energy than athletes in shorter events.
- Carbohydrate loading is a training and diet regimen that may store two to three times more glycogen than normal in the muscles.
- Carbohydrate loading should **only** be used by well-trained, endurance athletes two or three times a year.
- A "Loaf-Load" version of carbohydrate loading can fill the glycogen stores without overfilling them and can be used regularly.

BACKGROUND INFORMATION

Usually the muscles store about 275 grams of carbohydrate in the form of glycogen. This glycogen will fuel athletes in events lasting less than 60 minutes. However, athletes who are exercising constantly for 60 minutes or longer will deplete those glycogen stores. When they do, the athletes will become exhausted.

Some sports where this exhaustion may occur and where carbohydrate loading may be beneficial are:

crew/rowing	distance swimming
cross-country skiing	marathon
distance cycling	soccer
distance running	tournament tennis

Remember, only those events where athletes are exercising continuously for 60 minutes or longer will benefit from carbohydrate loading.

HOW DOES CARBOHYDRATE LOADING WORK?

Carbohydrate loading is a training and diet regimen that lasts one week. The training regimen has three parts:
- A long, hard training session which uses up the glycogen in the muscles.
- Three days of moderate training to keep muscle glycogen levels low.
- Three days of rest immediately before the competition. This allows athletes to store glycogen in their muscles.

The diet regimen has two parts:
- A normal diet on the day of the long, hard training session and during the three moderate training days.
- A high-carbohydrate diet during the three rest days.

The chart below outlines the regimen.

CARBOHYDRATE LOADING REGIMEN

Day	Training	Diet
7	Long, hard training	Basic diet
6	Moderate training	Basic diet
5	Moderate training	Basic diet
4	Moderate training	Basic diet
3	Rest	Carbohydrate-loading diet
2	Rest	Carbohydrate-loading diet
1	Rest	Carbohydrate-loading diet
0	Competition	Pre-competition meal

The training session is essential to the regimen. It should be a long, hard session, but it does not have to exhaust the athlete. However, it's only after the heavy exercise that athletes' muscles store the extra glycogen. The muscles that athletes use in the competition are the ones that must be exercised (and rested) during the regimen. For example, a marathoner would need to go for a long-distance run. A long swim or bicycle ride would not deplete the correct muscles.

The timing of the training session is also important. Athletes should have enough time to rest their muscles before competition. So at least three days of rest are essential for both storing the glycogen in the muscles and resting the exercised muscles.

In the late 1930's, two Swedish physicians, Eric Hultman and Jonas Bergstrom, demonstrated that eating large quantities of carbohydrate did not increase the glycogen stores of inactive muscles. Only when muscles were first depleted of glycogen by heavy exercise did a diet rich in carbohydrate cause more glycogen to be stored in the muscle fibers.

In other words, just eating lots of starchy or sugary food does not expand the muscle glycogen stores above their "normal" level. Muscles that have been exercised and are low in glycogen, however, are stimulated to store energy. As a result, muscles that are well-trained, rested, and properly nourished with carbohydrate will tend to store more glycogen than unexercised, untrained muscles.

The real "loading" phase of the regimen is the three days of the high-carbohydrate diet. This is when the muscles start storing up the glycogen—almost like a sponge soaks up water. A layoff from training is essential at this time, because any training would begin to use the glycogen that's being stored. During this phase of the regimen the muscles store two to three times the normal amount of glycogen in the muscle.

Note: Carbohydrate loading is a time-consuming regimen. Your serious, well-trained athletes may benefit from the additional glycogen stores. It is important that you and they are aware of the time and energy needed to correctly carbohydrate load.

ARE THERE ANY SIDE EFFECTS TO CARBOHYDRATE LOADING?

As carbohydrate loading increases the glycogen stores in the muscles, it also stores water. For each gram of glycogen stored, about three grams of water are stored. Due to the extra water, your athletes will gain weight. (This is actually one way you can tell if they are storing glycogen—you can expect a two- to seven-pound weight gain.) Although some claim that the water in the muscles causes a feeling of heaviness or stiffness, this claim has not been documented. The extra water can have an advantage, especially during warm-weather competition. As the glycogen stores are burned, the water will be released and can help to cool the athlete.

Athletes who are "at risk" for certain diseases, including cardiovascular disease, diabetes, and hypertriglyceridemia, may have problems if they carbohydrate load. Athletes should check with their doctors before attempting this regimen.

The seven-day technique of carbohydrate loading should be used sparingly—no more than two or three times a year—and, if used, only for endurance events (lasting continuously for one or more hours).

HOW CAN AN ATHLETE FILL THE GLYCOGEN STORES WITHOUT CARBOHYDRATE LOADING?

Athletes in all sports can benefit from full glycogen stores. A shortened version of carbohydrate loading, called "Loaf-Load," can fill these stores. In "Loaf-Load," athletes use the carbohydrate-loading diet for three days before competition. Their training is moderate on the first two days and they don't train on the day before competition. The following chart outlines the shortened regimen.

"LOAF-LOAD" REGIMEN

Day	Training	Diet
3	Moderate training	Carbohydrate-loading diet
2	Moderate training	Carbohydrate-loading diet
1	Rest	Carbohydrate-loading diet
0	Competition	Pre-competition meal

Athletes following this "Loaf-Load" will store enough glycogen to compete in most sports. And, more importantly, they avoid the risks of the complete carbohydrate-loading regimen.

To help athletes understand carbohydrate loading, use the handouts:
- How to Carbohydrate Load
- How to Select the Diet for You
- What You Need to Know about Food

BODY COMPOSITION

Peak performance depends on many factors, including a high proportion of muscle to fat.

KEY POINTS

- The extra weight athletes have may be due to body fat, not muscle.
- Body fat is fairly inactive, while muscles are active – that is muscles contract and relax to help athletes move.
- Athletes usually perform better if they have a greater proportion of muscle than body fat.
- You can estimate the amount of body fat athletes have and help them develop a greater proportion of muscle.
- Although some fat is essential for normal physiologic functions, excess storage fat can impair athletic performance.

BACKGROUND INFORMATION

Body fat serves as a store of extra energy (calories). The calories athletes don't use for growth, repair, and activity are stored as fat. But too much body fat is extra weight that athletes must carry around constantly.

Some body fat serves as insulation from the cold or as protection from injury. But an extra layer of clothes or a well-designed piece of equipment could serve these purposes better and athletes can take these off when they're no longer needed.

Well-developed muscles are the key to peak performance. Athletes rely on their muscles to contract and relax. Body fat does not contribute to the muscle contraction and relaxation that powers a sport. In fact, excess body fat means more work for the athlete.

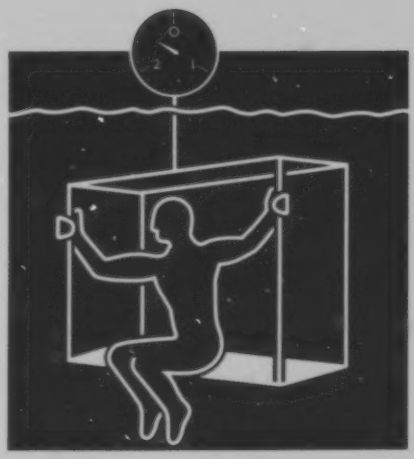
HOW CAN YOU TELL HOW MUCH BODY FAT ATHLETES HAVE?

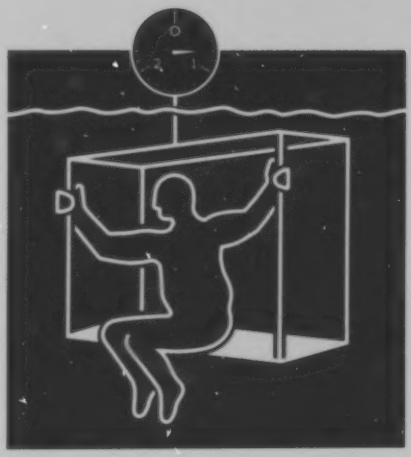
There are a number of ways to estimate the body fat of athletes. Some of them are much simpler than others. For example, athletes could run in place in front of a mirror. If anything jiggles that shouldn't (like the stomach, thighs, or arms), they may be too fat.

A more sophisticated test for body fat is underwater weighing. In fact, this test is the standard for all others. Underwater weighing requires a large volume of water (a tank or a swimming pool), a scale with a chair, and a trained expert. A number of laboratories and universities have the equipment and may be willing to test your athletes.

From the weight under water, the athlete's percent body fat is estimated. For example, an athlete with very little body fat will weigh more under water than an athlete with more body fat – even if their out-of-water weights are identical.

There are several other tests that you can use to estimate the body fat of athletes that don't require extensive equipment. These include skinfold measurements and circumferences.





On males, measure the skinfolds at the subscapula and the right thigh.

SUBSCAPULA

Subscapula – the bottom point of the scapula (shoulder blade)

THIGH

Thigh – the middle of the front side of the thigh halfway between the hip and the knee

Females are measured at the triceps and the suprailiac sites.

TRICEPS

Triceps – the back of the upper arm halfway between the shoulder and the elbow

SUPRAILIAC

Suprailiac – just over the top of the hip bone at the middle of the side of the body

HOW TO MEASURE SKINFOLDS

One way to find out how much body fat an athlete has is by measuring skinfold thicknesses with skinfold calipers. (See Appendix C, p.36 for inexpensive sources.) This method correlates well with underwater weighing and is an accepted method for estimating body fat.

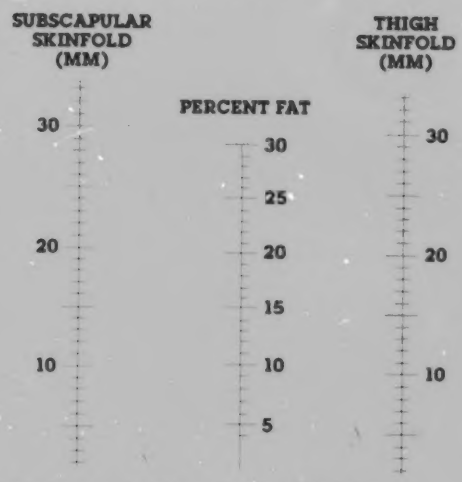
With calipers, skinfold measurements are taken at specific places on the athlete's body. One relatively easy method for predicting body fat is outlined below.

It is important that the skinfolds are measured properly with the calipers. To do so:

- Measure the skinfolds on the right side of the athlete's body using the skinfold calipers.
- Take the skinfold measurements vertically while the athlete is standing, except for the subscapular and suprailiac skinfolds. These are measured at a slight slant along the natural fold of the skin.
- Grasp the skinfold between your thumb and forefinger. Be sure to grasp only the skin and the fat just beneath the skin – not the muscle.
- Place the calipers around the skinfold, just below where your fingers are holding the fold. Go as deep into the fold as possible without pinching muscle. Record the measurement.
- Repeat the measurement at each site completely by regrasping the skinfold and applying the calipers. Record. If the difference between the two measurements is greater than 0.5 millimeters, take a third measurement. Average the two closest readings and use that measurement as the value for that site.

After measuring the skinfolds of an athlete and recording the measurements, use the following graphs to find the percent body fat. With a ruler, line up the two skinfold measurements (subscapula and thigh – males; triceps and suprailiac – females). The athlete's percent body fat is where this line crosses the percent fat column.

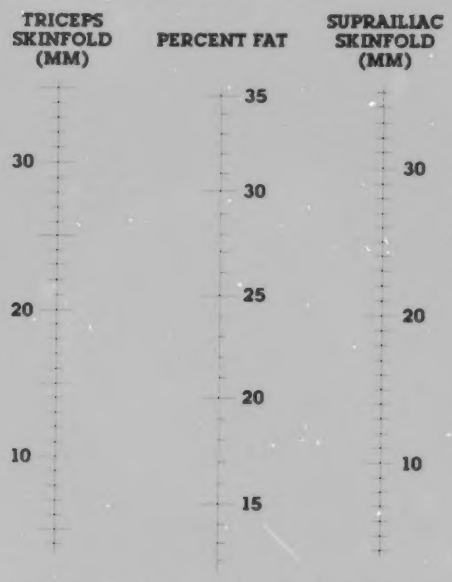
PERCENT BODY FAT/MEN



Nomogram for Conversion of Skinfolds to Percent Body Fat

*Source: A.W. Sloan. Estimates of body fat in young men. Journal of Applied Physiology 23:311, 1967.

PERCENT BODY FAT/WOMEN



Nomogram for Conversion of Skinfolds to Percent Body Fat

*Source: A.W. Sloan et. al. Estimation of body fat in young women. Journal of Applied Physiology 17:967, 1962.

HOW TO MEASURE CIRCUMFERENCES

Another way to find out how much body fat an athlete has is by measuring girths with a measuring tape. The circumference method of calculating body fat is relatively accurate, although not as accurate as skinfold measurements. Depending on their age and sex, measure athletes at the following places (see sketch for accurate locations):

MALES, 15 TO 26 YEARS OLD
- right upper arm (halfway between the shoulder and the elbow, with the arm straight)
- abdomen (½ inch above the navel)
- right forearm (the widest part between the elbow and wrist)

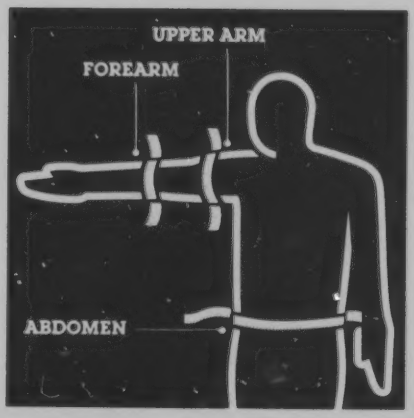
MALES, 27 TO 50 YEARS OLD
- buttocks (maximum protrusion with heels together)
- abdomen (½ inch above the navel)
- right forearm (the widest part between the elbow and wrist)

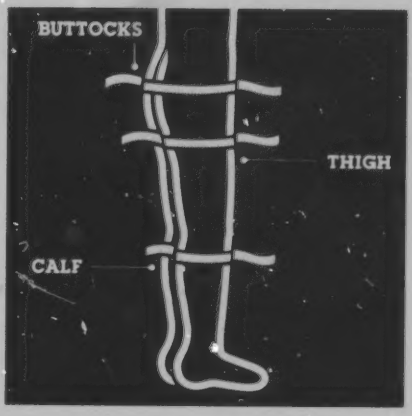
FEMALES, 15 TO 26 YEARS OLD
- abdomen (½ inch above the navel)
- right thigh (just below the buttocks)
- right forearm (the widest part between the elbow and wrist)

FEMALES, 27 TO 50 YEARS OLD
- abdomen (½ inch above the navel)
- right thigh (just below the buttocks)
- right calf (the widest part halfway between the ankle and knee)

After measuring an athlete and recording the measurements, change the measurements to constants and calculate the percent body fat using the formulas on the following pages.*

*This method of calculating body fat is adapted from William McArdle, Frank Katch and Victor Katch's Exercise Physiology. Philadelphia: Lea and Febiger, 1981.





MALES, 15 TO 26 YEARS OLD

Upper Arm		Abdomen		Right Forearm	
Measurement	Constant	Measurement	Constant	Measurement	Constant
7"	26	21"	28	7"	38
8"	30	22"	29	8"	43
9"	33	23"	30	9"	49
10"	37	24"	31	10"	54
11"	41	25"	33	11"	60
12"	44	26"	34	12"	65
13"	48	27"	35	13"	71
14"	52	28"	37	14"	76
15"	56	29"	38	15"	81
16"	59	30"	39	16"	87
17"	63	31"	41	17"	92
18"	67	32"	42	18"	98
19"	70	33"	43	19"	103
20"	74	34"	45	20"	109
21"	78	35"	46	21"	114
22"	81	36"	47	22"	119
		37"	49		
		38"	50		
		39"	51		
		40"	52		
		41"	54		
		42"	55		

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Upper arm constant _____
Abdomen constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 10*

Approximate body fat _____ %

*For athletes, use 14 instead.

MALES, 27 TO 50 YEARS OLD

Buttocks		Abdomen		Right Forearm	
Measurement	Constant	Measurement	Constant	Measurement	Constant
28"	29	26"	23	7"	21
29"	30	27"	24	8"	24
30"	31	28"	25	9"	27
31"	32	29"	26	10"	30
32"	34	30"	27	11"	33
33"	35	31"	28	12"	36
34"	36	32"	29	13"	39
35"	37	33"	30	14"	42
36"	38	34"	30	15"	45
37"	39	35"	31	16"	48
38"	40	36"	32	17"	51
39"	41	37"	33	18"	54
40"	42	38"	34		
41"	43	39"	35		
42"	44	40"	36		
43"	45	41"	37		
44"	46	42"	38		
45"	47	43"	39		
46"	48	44"	40		
47"	49	45"	40		
48"	50				
49"	51				

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Buttocks constant _____
Abdomen constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 15*

Approximate body fat _____ %

*For athletes, use 19 instead.

FEMALES, 15 TO 26 YEARS OLD

Abdomen		Right Thigh		Right Forearm	
Measurement	Constant	Measurement	Constant	Measurement	Constant
20"	27	14"	29	6"	26
21"	28	15"	31	7"	30
22"	29	16"	33	8"	34
23"	31	17"	35	9"	39
24"	32	18"	37	10"	43
25"	33	19"	40	11"	47
26"	35	20"	42	12"	52
27"	36	21"	44	13"	56
28"	37	22"	46	14"	60
29"	39	23"	48	15"	65
30"	40	24"	50	16"	69
31"	41	25"	52	17"	73
32"	43	26"	54	18"	78
33"	44	27"	56	19"	82
34"	45	28"	58	20"	86
35"	47	29"	60		
36"	48	30"	62		
37"	49	31"	65		
38"	51	32"	67		
39"	52	33"	69		
40"	53	34"	71		

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Abdomen constant _____
Thigh constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 20*

Approximate body fat _____ %

*For athletes, use 23 instead.

FEMALES, 27 TO 50 YEARS OLD

Abdomen		Right Thigh		Right Calf	
Measurement	Constant	Measurement	Constant	Measurement	Constant
25"	30	14"	17	10"	14
26"	31	15"	19	11"	16
27"	32	16"	20	12"	17
28"	33	17"	21	13"	19
29"	34	18"	22	14"	20
30"	36	19"	23	15"	22
31"	37	20"	24	16"	23
32"	38	21"	26	17"	25
33"	39	22"	27	18"	26
34"	40	23"	28	19"	27
35"	42	24"	29	20"	29
36"	43	25"	31	21"	30
37"	44	26"	32	22"	32
38"	45	27"	33	23"	33
39"	46	28"	35	24"	35
40"	48	29"	36	25"	36
41"	49	30"	37		
42"	50	31"	38		
43"	51	32"	40		
44"	52	33"	41		
45"	53	34"	42		

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Abdomen constant _____
Thigh constant + _____

Subtotal _____
Calf constant − _____

Subtotal _____
− 18*

Approximate body fat _____ %

*For athletes, use 21 instead.

HOW MUCH FAT IS IDEAL FOR ATHLETES?

A number of body fat studies have been done on athletes and the results give body fat values that differ both between sports and within sports. The body fat values for male and female athletes in various sports are given in the chart below.*

Athletic Group or Sport	Body Fat Males %	Body Fat Females %
Baseball	10-15	–
Basketball	7-12	18-27
Canoeing	10-14	–
Football	8-18	–
Gymnastics	3-6	8-18
Ice Hockey	12-16	–
Jockeys	6-16	–
Skiing		
Alpine	10-17	–
Cross-Country	7-13	18-24
Nordic	8-14	–
Ski-Jumping	12-16	–
Soccer	7-12	–
Speed Skating	8-14	–
Swimming	4-10	12-20
Track and Field		
Runners	4-12	8-18
Jumpers/Hurdlers	–	12-22
Discus	12-18	22-28
Shot Put	14-20	23-30
Tennis	12-16	–
Volleyball	–	20-23
Weight Lifting	6-16	–
Wrestling	6-12	–

*from Jack H. Wilmore's The Wilmore Fitness Program. Simon & Schuster, 1981

As you can see, there isn't any single value for body fat for all athletes or even for all athletes of a given sex or in a given sport. So, an ideal percent body fat is impossible to establish.

However, minimum levels of body fat have been estimated for males and females. In males, seven percent body fat is considered the **minimum**, especially during growth. Twelve percent body fat is the **minimum** for females – both for growing athletes and for mature adults. Athletes with body fat values below these minimum values may not only impair athletic performance, but also endanger normal body functions. For example, menstruation may stop in females who drop below their minimum body fat level.

MINIMUM BODY FAT LEVELS
Males – 7 percent body fat
Females – 12 percent body fat

Some experts recommend 10-12 percent body fat for men and 18-20 percent for women. However, other experts have recommended that well-conditioned male athletes have 7-8 percent body fat and female athletes have 17-18 percent.

RECOMMENDED BODY FAT LEVELS
- Well-conditioned male athletes 7-8 percent body fat
- Well-conditioned female athletes 17-18 percent body fat
- Normally active men 10-12 percent body fat
- Normally active women 18-20 percent body fat

To identify the appropriate percent body fat for athletes:

1. Select a technique for determining their body fat. Enlist the assistance of an athletic trainer, exercise physiologist, sports physical therapist, team physician, or dietitian to help you select the technique to determine the body fat values.

2. Set an acceptable range of fat values for athletes, depending on their sport.

Take into consideration each athlete's performance in previous years. For example, a football player who has been outstanding at 15 percent body fat shouldn't be told to drop to eight percent body fat, just because that's the lowest value in that range.

Also allow for individual differences and errors in the technique. Again, it may be helpful to enlist the help of a trainer, physiologist, sports therapist, physician, or dietitian.

3. Measure the athletes, calculate their percent body fat, and recommend a competitive weight.

4. With the help of a dietitian, an exercise physiologist, and/or a trainer, set up a diet and exercise program to achieve this weight. It is important to allow a reasonable time period for fat loss – not more than two pounds a week.

Once athletes are losing fat through a diet and exercise program, estimate their percent body fat periodically – about once a month. It is important that they lose body fat and not muscle, since muscle is the active tissue needed for peak performance.

Note: During a diet and exercise program, an athlete may gain muscle while losing fat. And muscle weighs more than fat. Therefore, the athlete's weight may not change as much as expected.

HOW TO GAIN MUSCLE

Heavy muscular overload or strength training is an effective way to increase muscle mass and strength. Building muscular strength depends on three basic principles – specificity, overload, and progression. All three principles must be used to build maximum muscular strength.

In as little as a four-week period, exercising three times a week, athletes can improve their muscular strength. Rest and recovery days between exercise days are essential for muscle growth. While the exercise stimulates muscle growth, the rest and recovery give the muscles the time necessary to grow.

In addition to the strength training, extra calories are essential for muscle growth. For each pound of weight gained as muscle, the athlete needs about 2500 Calories – that's in addition to the calories needed to maintain weight.

A reasonable weight gain as muscle is one to two pounds a week. To accomplish this gain, about 700 to 1000 Calories should be added to the athlete's normal diet daily. This increase in calories will provide energy for the increased training and the muscle development.

The extra calories needed for muscular growth should come from a wide variety of foods in the Four Food Groups – Milk, Meat, Fruit-Vegetable, and Grain. The concept that only protein builds muscle is not accurate. Although protein is required for the growth of tissue, there isn't any evidence that more protein will increase muscle tissue growth during training. In fact, excess protein is broken down and stored in the body as fat.

To help athletes measure their body fat and gain or lose weight, use the handouts:
- How to Measure Your Body Fat – Men or Women
- How to Gain Weight
- How to Build Muscles
- How to Lose Weight

WEIGHT CONTROL

Energy intake and energy output can be adjusted to gain, lose, or maintain weight.

KEY POINTS

- To maintain weight, athletes need to balance what they eat against what their bodies use.
- To lose weight, athletes need to eat less, exercise more, or do a combination of the two.
- To gain weight, athletes need to eat more, exercise less, or do a combination of the two.

BACKGROUND INFORMATION

You probably have a diverse group of athletes—some may need to lose weight, others gain, while still others just need to stay at their present weight.

HOW CAN YOU HELP ATHLETES WITH THESE DIFFERENT NEEDS?

To help athletes plan a weight control program that meets their individual needs, keep in mind that:

- Energy output is the energy used in normal activities (like sitting, reading, walking) and in exercises (like sports or recreational activities).
- Energy intake is the energy obtained from the foods eaten.
- Energy output and energy intake can be regulated to gain, lose, or maintain weight.

ENERGY OUTPUT

Each individual has a specific requirement for energy. Age, sex, and activity level affect this energy requirement. However, based on average daily energy use, daily energy recommendations have been made by the government for normally active men and women. These recommendations are based on the energy needed for body functions, such as breathing and digestion, and normal physical activities, such as walking, sitting, and reading.

DAILY ENERGY RECOMMENDATIONS FOR NORMALLY ACTIVE MALES AND FEMALES

Males	Energy Needs	
Age Years	**Total Energy** Calories	**Calories** Per Pound
11-14	2700	27
15-18	2800	19
19-22	2900	19
23-50	2700	18
51-75	2400	16
76+	2050	13

Females	Energy Needs	
Age Years	**Total Energy** Calories	**Calories** Per Pound
11-14	2200	22
15-18	2100	18
19-22	2100	18
23-50	2000	17
51-75	1800	15
76+	1600	13

Source: Recommended Dietary Allowances. Washington, DC: National Academy of Sciences, 1980. (Calories/pound figures were calculated from this source.)

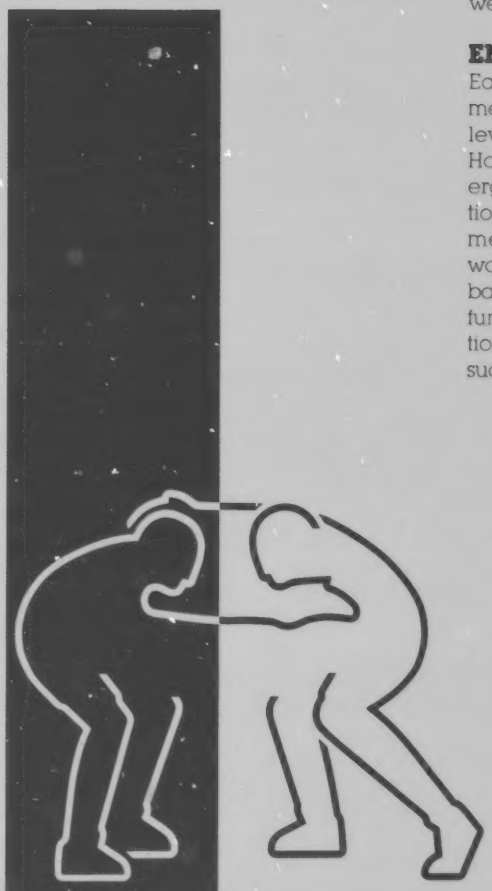
In addition to the energy needed for body functions and normal daily activities, athletes need additional energy for sports. The following chart lists some sports and the estimated energy needs for competition and for training.

ENERGY REQUIREMENTS FOR VARIOUS SPORTS

Activity	Competition	Training
	Calories (est.) Per Event	Calories (est.) Per Hour
Cycling	1000 (1 hour)	750
Football	100 (11 minutes)	250
Gymnastics	6½ (1 minute)	100
Racquetball	612 (1 hour)	612
Running		
(2-mile race)	215 (11 minutes)	852
(4-mile race)	384 (24 minutes)	852
(6-mile race)	540 (36 minutes)	852
Swimming	40 (4 minutes)	600
Wrestling	225 (9 minutes)	600

Source: Compiled from various sources by D.L. Costill.

An athlete's total energy output is based on the energy needed for body functions, for normal, daily activities, and for training and competition.



It is this total energy output that athletes should be aware of when trying to control their weight. But energy output isn't all they need to look at. Energy intake is also very important to weight control.

ENERGY INTAKE

Energy intake is the total energy from foods eaten—whether the foods are meals, snacks, or beverages. Some athletes consume as many as 5000 Calories a day, while others are "starving" themselves on 1200 Calories a day.

To find out how many calories your athletes get during a normal 24-hour period, have them keep a food record for a typical day. A list of the types and amounts of foods eaten should be made. The type of preparation (e.g. fried, boiled) and the extras added (e.g. catsup, salad dressing) should also be noted. This information can then be used as the basis for a weight control program.

HOW TO MAINTAIN WEIGHT

ENERGY OUTPUT MUST EQUAL ENERGY INTAKE.

If athletes want to maintain their present weight, they must take in the same amount of energy as they use up. For example, a 145-pound athlete who burns up 4000 Calories (body functions, normal daily activities, and exercise) would need to eat 4000 Calories worth of food (meals, snacks, and beverages). Weigh your athletes about once a week to be sure they are maintaining their weight.

HOW TO LOSE WEIGHT

ENERGY OUTPUT MUST BE GREATER THAN ENERGY INTAKE.

If athletes want to lose weight, they must take in fewer calories than they use. They can do this by eating less, exercising more, or a combination of the two.

For each pound of body fat they need to lose, athletes must eliminate 3500 Calories. A two-pound loss in a week requires a reduction of 7000 Calories—that's 1000 fewer Calories each day.

Diet is one way to lose weight. However, it is difficult to meet the energy needs of training and competition while also cutting food intake by 500 Calories or more each day. In addition, more muscle (and less fat) is lost when weight is taken off by diet alone.

Exercise is another way to lose weight. Athletes can lose weight (if they usually maintain their weight during training) by increasing activity levels above and beyond their normal training program. For example, an hour of cycling daily would burn 750 Calories. Over a week, that alone would be about 5200 Calories or about one and one-half pounds. So without changing their diets, athletes could still lose weight.

A combination of diet and exercise may be the most effective way to lose weight. More fat is lost through a combination of diet and exercise than by diet alone or exercise alone. A decrease in daily food intake (500 Calories) and an increase in daily exercise (500 Calories) would result in a 1000-Calorie deficit each day. At that rate, 7000 Calories, or two pounds of weight, could be lost in a week.

It is best for athletes to lose their weight before the competitive season begins, so they're at their optimal performance weight by the time competition starts. Athletes can **safely** lose one to two pounds a week even while they are training. At that rate, they'll be losing body fat. If they lose weight faster than one to two pounds a week, they may begin to break down muscle. And that will harm their training and performance.

During the season, athletes—even when losing weight—need at least 2000 Calories each day to maintain normal activities and continue training. Without at least 2000 Calories, they may not have sufficient energy to train adequately. Teenagers generally need a minimum of 1500 Calories from food to meet their nutrient needs. And adults need at least 1200 Calories to meet their needs.

Athletes who must eat fewer than 2000 Calories per day during training to maintain weight or lose weight should be aware of the possible consequences in their performance. For these athletes, weight loss/maintenance should begin far in advance of the season and increased exercise should be encouraged during the season, rather than decreased food intake.

Note: Athletes need to be aware of the dangers of losing weight during growth. These athletes should not restrict their energy intake (and also their nutrient intake). Instead, they should be encouraged to maintain their weight and allow their height to "catch up" with their weight.

MAKING WEIGHT

Athletes who must "make weight" for competition have probably tried everything possible to take off pounds overnight. But often the methods they use actually harm their performance and their health. For example, athletes who restrict food and water and/or exercise in plastic or rubber suits decrease their muscular endurance and their muscle glycogen levels. They also decrease their muscle water content and impair their sweating-cooling mechanism. Rapid weight loss programs are dangerous and do not allow the athlete to compete at his or her optimal performance level.

Athletes who voluntarily dehydrate to "make weight" risk the dangers of circulatory collapse and heat exhaustion in addition to limiting their performance. With as little as a 3-4 pound loss of water in a 150-pound athlete, the symptoms of dehydration can be apparent and the athlete cannot perform up to his or her potential.

If an athlete is concerned about "making weight," the most effective way is to decrease the amount of body fat the athlete has. To help an athlete "make weight" safely, follow the steps listed below:

- Estimate the percent body fat of the athlete prior to the competitive season (see pp.21-25).
- Calculate the excess body fat and the high-performance weight with the following formulas.

—Subtract 7%(Males) or 12%(Females) from the athlete's present level of body fat.

present body fat			body fat to lose
_____%	– 7% (or 12%)	=	_____%

—Multiply the percent of body fat to lose by the athlete's present weight.

body fat to lose		present weight		weight to lose
____%	x .01 x	____pounds	=	____ pounds

—Subtract the weight to lose from the athlete's present body weight.

present weight		weight to lose		high-performance weight
____pounds	–	____pounds	=	____ pounds

- Keep in mind that some of the athlete's body fat should be replaced with muscle (which weighs more than fat). So the high-performance weight may not be as low as calculated.
- Allow enough time for a loss of one to two pounds of body fat a week. For example, a minimum of eight weeks are necessary for a loss of 16 pounds of body fat.
- Supervise a diet and exercise program that results in a loss of body fat and gain of muscle.

HOW TO GAIN WEIGHT

ENERGY OUTPUT MUST BE LESS THAN ENERGY INTAKE.

Gaining weight may sound easy, but it can be very difficult for an athlete during hard training. Since it is important that athletes be at their competitive weight when the season begins, a weight-gain program must be started early. Athletes who want to gain weight must increase the calories they take in over what they use in activity.

Weight gain for athletes should probably be in the form of muscle. And weight gains in muscle can be obtained through a diet **and** exercise program. The diet must contain extra calories to build the muscle and to maintain normal activity. Exercise is necessary to increase muscle mass. A gain of one pound of muscle requires 2500 **extra** Calories, in addition to the calories needed for the exercise. This is roughly 350 extra Calories a day for a weekly one-pound gain of muscle. (See page 26 for further discussion of muscle development.)

To help athletes understand the principles of weight control and plan their own weight control programs, use the handouts:

- How to Lose Weight
- How to Gain Weight
- How to Measure Your Body Fat—Men or Women
- How to Select the Diet for You
- What You Need to Know about Food

THE FOLLOWING DIET SUPPLIES ABOUT 2000 CALORIES FOR TRAINING AND NORMAL ACTIVITIES:

Milk Group (milk, cheese, yogurt, cottage cheese, ice cream) A serving = 1 cup milk, yogurt 1 slice cheese ½ cup cottage cheese ½ cup ice cream	4 servings-teenagers 2 servings-adults
Meat Group (meat, fish, poultry, eggs, dry beans and peas, nuts) A serving = 2 oz cooked, lean meat, fish, poultry 2 eggs 1 cup cooked dry beans, peas 4 Tbsp peanut butter	2 servings
Fruit-Vegetable Group (fresh, frozen, canned, dried, and juiced fruits and vegetables) A serving = ½ cup cooked or juice 1 cup raw 1 medium fruit or vegetable	8 servings
Grain Group (cereals, breads, rolls, pasta, muffins, pancakes, grits) A serving = 1 slice bread 1 cup ready-to-eat cereal ½ cup cooked cereal, pasta, grits 1 roll, biscuit, muffin, bagel, pancake	8 servings

HERE ARE SOME SAMPLE MENUS FOR THIS DIET:

	Sample Meal	Sample Meal	Sample Meal
Breakfast			
Milk	8 fl oz lowfat milk	8 fl oz lowfat milk	8 fl oz milk
Meat	–	–	–
Fruit-Vegetable	8 fl oz grape juice	8 fl oz orange juice	8 fl oz orange juice
Grain	2 pancakes	1 cup cereal 2 blueberry muffins	1 cup branflakes with raisins
"Others"	syrup	sugar butter	sugar
Lunch			
Milk	2 slices swiss cheese	cheese on pizza	11 fl oz chocolate milkshake
Meat	2 slices ham	sausage on pizza	3 oz hamburger
Fruit-Vegetable	1 carrot 1 orange	salad pizza sauce 4 fl oz grape juice	10 french fries
Grain	2 slices bread	pizza crust-2 slices	hamburger bun
"Others"	1 brownie	salad dressing	catsup mustard
Dinner			
Milk	cheese on spaghetti	8 oz fruit yogurt	8 fl oz milk
Meat	2 oz ground beef	2 oz fried chicken	3 oz sirloin steak
Fruit-Vegetable	lettuce and tomato 1 cup spaghetti sauce 1 banana	½ cup broccoli ½ cup mashed potatoes	salad 1 cup peas 1 baked potato
Grain	2 cups spaghetti 2 slices italian bread	2 biscuits	3 slices french bread
"Others"	salad dressing butter	gravy	butter salad dressing
Snacks			
Milk	8 fl oz lowfat milk	1 oz cheddar cheese	1 oz swiss cheese
Fruit-Vegetable	½ cup strawberries	1 apple & 1 banana	1 pear & 1 banana
Grain	–	5 saltine crackers	2 slices bread

SPORTS MISINFORMATION

Nutrition misinformation can hurt an athlete's performance.

KEY POINTS

- There are no miracle foods or nutrients that improve athletic performance.
- The use of drugs or supplements can be dangerous and a waste of time and money.
- A nutritionally adequate diet is important to an athlete's performance and can be obtained by eating a wide variety of foods from the Four Food Groups (Milk, Meat, Fruit-Vegetable, and Grain).

BACKGROUND INFORMATION

Many nutrition practices that contribute nothing to athletic performance still are widely used. Some of this nutrition misinformation comes from misinformed but successful athletes, poorly designed research studies, invalid commercial advertising claims, or misinterpretation of facts. By giving athletes sound nutrition information, you can help them prepare, nutritionally, to perform at their full potential.

MUSCLE-BUILDING MYTHS

MYTH:
Consuming large amounts of protein or taking protein supplements will increase muscle size and strength.

FACT:
Excess protein will not increase muscle growth or muscle strength. Heavy muscular workouts stimulate the growth and, therefore, the strength of muscle. Extra calories are needed to gain weight as muscle. But a wide variety of food from the Four Food Groups will supply these calories. (See pages 26 & 29 for more information.)

MYTH:
Steroids build muscle.

FACT:
Body builders occasionally take steroids in hopes of developing massive muscles. But steroids do not increase muscle growth or strength. It's exercise that brings about muscle growth and strength.

In addition, steroids can be dangerous. These drugs can stunt an athlete's growth, cause acne, deepen the voice, and alter the sex organs. Some of these side effects can be permanent. In addition, studies have found that athletes who train properly and eat nutritionally adequate diets perform the same with or without steroids.

MYTH:
Vegetarian athletes cannot get enough protein to develop muscles and maintain strength.

FACT:
A vegetarian athlete can obtain all the nutrients needed for top performance by eating a wide variety of foods. The Four Food Groups serve as the basis for vegetarian diets. Meat alternates, such as dry beans and peas, nuts, soy products, eggs, and cheese, supply protein and other nutrients usually supplied by meats.

Strict vegetarians, or vegans, eat only foods from plant sources. If an athlete is a vegan, he or she must be sure to combine plant proteins to form a complete protein source. For example, beans and corn (a bean burrito) or peanuts and wheat (peanut butter on whole wheat bread) supply the protein necessary for optimal performance.

Athletes who do not eat any animal products (even milk, milk products, or eggs) may need a vitamin B_{12} supplement. Check with the team physician or dietitian for advice.

QUICK-ENERGY MYTHS

MYTH:
Eating honey, sugar, soft drinks, or a candy bar is an excellent way to get quick energy just before competition or practice.

FACT:
Sweets eaten or drunk an hour or less before competition can cause a reaction called hypoglycemia or low blood sugar.

The energy used for competition or practice comes from foods eaten days and even weeks prior to the event. A high-carbohydrate diet from the Four Food Groups and adequate training will enable your athletes to perform at their best. (See pages 16-20 for more information.)

MYTH:
Athletes require extra vitamins and minerals and should take vitamin pills to "supercharge" their bodies.

FACT:
Many vitamins and minerals can't be stored by the body – so it's impossible to "supercharge" the body. And vitamins and minerals don't supply energy.

Taking large amounts of some vitamins (particularly A and D) can be harmful; they are stored in the athlete's fat stores.

Other vitamins, like vitamin C or the B vitamins, are simply flushed out in the urine and are, therefore, a waste of money. (See page 9 for more information.)

MYTH:
Tea and coffee are the best pre-competition beverages.
FACT:
Tea and coffee contain caffeine which is a stimulant. Some researchers have found that caffeine can improve endurance performance only in events lasting longer than two hours. They found that drinking a caffeine-containing beverage about an hour before an event stimulated the use of fat as a fuel instead of carbohydrate. Therefore, less muscle glycogen was burned and an athlete could perform longer.

However, not all athletes will get this effect from caffeine. In fact, a negative, hypersensitive response may occur in some athletes. There is also an increase in urine production, which can lead to dehydration.

MYTH:
Amphetamines will give athletes more energy and will improve performance.
FACT:
There is no proof that amphetamines give athletes more energy or improve their performance. However, there is proof that amphetamines can be harmful – both physically and psychologically.

The physical side effects include: a rise in blood pressure, pulse rate, cardiac output, breathing rate, metabolism, and blood sugar level. In addition, headaches, dizziness, and confusion can lead to poor performance, especially in sports requiring quick reactions.

Amphetamines may also have a serious psychological effect on an athlete's performance – addiction.

PERFORMANCE MYTHS

MYTH:
Milk before an event causes cotton mouth, decreases speed, and cuts wind.
FACT:
"Cotton mouth" is a dryness and discomfort in the mouth. It appears to be due to emotional stress and fluid loss, not due to drinking milk. In fact, studies show no performance (speed or wind) decline when the diet includes milk. Even when included in the pre-competition meal, 6-10 ounces of milk will not interfere with performance.

MYTH:
Drinking water during an event or practice causes cramps and upset stomach and slows the athlete down.
FACT:
Water is the most important nutrient for your athletes – especially during hot weather. Even ice cold water does not cause cramps or stomach upset. However, a lack of water may slow your athletes down.

Athletes should drink ½ cup of cool, plain water every 10-15 minutes during exercise to replace body fluids lost as sweat. (See pages 11-13 for more information.)

MYTH:
Salt tablets are necessary to replace that lost in sweat.
FACT:
Sweat contains relatively little salt. The athlete's normal diet usually supplies enough salt to replace whatever the body loses as sweat. In addition, the kidneys control the amount of salt in the body. They conserve salt if too little is taken in and they excrete more if too much is consumed.

Salt tablets can irritate the stomach and can aggravate an existing dehydration problem if taken without lots of water. If one salt tablet is taken, two cups of water should be consumed to dissolve and dilute the tablet. (See pages 12-13 for more information.)

MYTH:
Eating steak and eggs before an event will improve performance.
FACT:
High-protein meals eaten on the day of the event contribute little to energy production and performance. High-protein foods stay in the stomach a long time and can cause indigestion, nausea, and even vomiting if eaten within a few hours of competition. (See pages 18-19 for more information.)

To help athletes separate nutrition fact's from fallacies, use the handout:
- What You Need to Know about Sports Nutrition Myths

APPENDIX

APPENDIX A | COMPREHENSIVE LIST OF FOODS*

MILK GROUP

	Calories	Protein g	Carbohydrate g	Fat g	Vitamin A IU	Vitamin C mg	Thiamin (B_1) mg	Riboflavin (B_2) mg	Niacin mg	Calcium mg	Iron mg
Buttermilk, 1 cup	99	8	12	2	81	2	0.08	0.38	0.1	285	0.1
Cheese, American, 1 oz, 1 slice	106	6	–	9	343	0	0.01	0.10	Trace	174	0.1
Cheese, Cheddar, 1 oz, 1 slice	114	7	–	9	300	0	0.01	0.11	Trace	204	0.2
Cheese, Cottage, ½ cup	109	13	3	5	171	Trace	0.02	0.17	0.1	63	0.2
Cheese, Swiss, 1 oz, 1 slice	107	8	1	8	240	0	0.01	0.10	Trace	272	0.1
Cocoa, ¼ cup	164	7	19	7	239	2	0.08	0.33	0.3	224	0.6
Ice Cream, Vanilla, ½ cup, ¼ pint	135	2	16	7	272	–	0.03	0.17	0.1	88	0.1
Milk, 1 cup	150	8	11	8	307	2	0.09	0.40	0.2	291	0.1
Milk, Chocolate, 1 cup	208	8	26	8	307	2	0.09	0.41	0.3	280	0.6
Milk, Lowfat (2%), 1 cup fortified with vitamin A	121	8	12	5	500	2	0.10	0.40	0.2	297	0.1
Milk, Skim, 1 cup fortified with vitamin A	86	8	12	–	500	2	0.09	0.34	0.2	302	0.1
Milkshake, Chocolate, 10.6 oz container	356	9	63	8	258	0	0.14	0.67	0.4	396	0.9
Pudding, Chocolate, ½ cup	161	4	30	4	169	Trace	0.03	0.20	0.1	133	0.4
Yogurt, Strawberry, 1 cup	225	9	42	3	111	1	0.08	0.37	0.2	314	0.1

MEAT GROUP

Bacon, 2 slices	92	5	1	8	0	–	0.08	0.05	0.8	2	0.5
Beans, Refried, ½ cup	142	9	26	1	–	–	–	–	–	5	–
Beef, Roast, 3 oz	182	26	0	8	17	–	0.04	0.20	3.9	11	3.2
Beef Liver, 3 oz	195	23	5	9	45,417	23	0.22	3.56	14.0	9	7.5
Bologna, 1 slice	86	3	–	8	0	–	0.05	0.06	0.7	2	0.5
Chicken, Fried, 3 oz	201	26	2	9	148	–	0.06	0.38	5.9	12	2.0
Egg, Fried, large	83	5	1	6	286	0	0.03	0.13	Trace	26	0.9
Egg, Hard-cooked, large	79	6	1	6	260	0	0.04	0.14	Trace	28	1.0
Egg, Scrambled, large	95	6	1	7	311	13	0.04	0.16	Trace	47	0.9
Frankfurter, 2 oz	172	7	1	15	–	–	0.09	0.11	1.4	3	0.9
Ham, Baked, 3 oz	179	26	0	8	0	–	0.56	0.26	4.9	11	3.2
Meat Loaf, 3 oz	230	15	13	12	106	Trace	0.27	0.24	3.4	68	2.4
Meat Patty, 3 oz	186	23	0	10	17	–	0.08	0.20	5.1	10	3.0
Peanut Butter, 2 tbsp	1[illegible]5	9	6	16	–	0	0.04	0.04	5.0	20	0.6
Peanuts, Salted, ¼ cup	211	9	7	18	–	0	0.12	0.05	6.2	27	0.8
Peas, Blackeye (immature), ½ cup	134	10	22	1	434	21	0.37	0.14	1.7	30	2.6
Peas, Blackeye (mature), ½ cup	94	6	17	–	12	–	0.20	0.05	0.5	21	1.6
Perch, Fried, Breaded, 3 oz	193	16	6	11	–	–	0.09	0.09	1.5	28	1.1
Pork Chop, 3 oz	308	21	0	24	0	–	0.82	0.24	4.9	9	2.7
Sausage, 2 links	135	5	–	13	0	–	0.22	0.10	1.1	2	0.7
T-Bone Steak, 3½ oz	212	29	0	10	19	–	0.08	0.22	5.6	11	3.5
Tuna, 3 oz	168	25	0	7	68	–	0.04	0.10	10.1	7	1.6

*In most cases food values were calculated from the amounts given for 100 gram portions in Composition of Foods, Agriculture Handbook No 8. Dairy products and eggs are from Agricultural Handbook No. 8-1

FRUIT-VEGETABLE GROUP

	Calories	Protein g	Carbohydrate g	Fat g	Vitamin A IU	Vitamin C mg	Thiamin (B_1) mg	Riboflavin (B_2) mg	Niacin mg	Calcium mg	Iron mg
Apple, medium	80	–	20	1	124	6	0.04	0.03	0.1	10	0.4
Applesauce, ½ cup	116	–	30	–	51	1	0.03	0.01	Trace	5	0.6
Apricots, Dried, 4 halves	39	1	10	–	1635	2	Trace	0.02	0.5	10	0.8
Asparagus, 4 spears, ½ cup	12	1	2	–	540	16	0.10	0.11	0.8	13	0.4
Banana, medium	101	1	26	–	226	12	0.06	0.07	0.8	10	0.8
Beans, Green, ½ cup	16	1	3	–	338	8	0.04	0.06	0.3	31	0.4
Beans, Lima, ½ cup	94	7	17	–	238	14	0.15	0.09	1.1	40	2.1
Broccoli, stalk, ½ cup	20	2	4	–	1938	70	0.07	0.16	0.6	68	0.6
Cabbage, ⅙ head, ½ cup	13	1	3	–	87	17	0.01	0.01	0.1	30	0.2
Cantaloupe, ¼ medium	29	1	7	–	3273	32	0.04	0.03	0.6	13	0.4
Carrots, ½ cup	22	1	5	–	7613	4	0.04	0.04	0.4	24	0.4
Carrot Sticks, 5" carrot	21	1	5	–	5500	4	0.03	0.03	0.3	19	0.4
Cauliflower, ½ cup	13	1	3	–	36	33	0.05	0.05	0.4	13	0.4
Celery Sticks, 8" stalk	10	1	2	–	136	5	0.02	0.02	0.2	22	0.2
Coleslaw, ½ cup	82	1	3	8	91	16	0.03	0.03	0.2	25	0.2
Corn, ½ cup	70	2	16	1	291	3	0.02	0.04	0.8	4	0.4
Corn, 5" ear	114	4	26	1	500	11	0.15	0.13	1.8	4	0.8
Fruit Salad, ½ cup apple, orange, banana, lettuce	99	2	25	1	530	44	0.11	0.08	0.7	45	0.9
Grapefruit, Pink ½ medium	48	1	13	–	94	45	0.05	0.02	0.2	19	0.5
Grapes, ½ cup	48	–	12	–	71	3	0.04	0.02	0.2	9	0.3
Greens, ½ cup mustard greens, kale, turnip greens	17	2	3	–	5306	36	0.08	0.13	0.4	104	1.4
Lettuce, ⅙ head, ½ cup	10	1	2	–	250	5	0.05	0.05	0.2	15	0.4
Okra, 4 pods, ½ cup	12	1	3	–	208	9	0.06	0.08	0.4	39	0.2
Orange, medium	65	1	16	–	263	66	0.13	0.05	0.5	54	0.5
Orange Juice, ½ cup	56	1	13	–	249	56	0.11	0.01	0.4	11	0.1
Peaches, ½ cup	100	1	26	–	550	4	0.01	0.03	0.8	5	0.4
Pear, medium	101	1	25	1	33	7	0.03	0.07	0.2	13	0.5
Peas, Green, ½ cup	54	4	9	–	480	10	0.22	0.07	1.4	15	1.5
Pineapple, large slice	90	–	24	–	61	9	0.10	0.02	0.2	13	0.4
Potato, Baked, large	132	4	30	–	Trace	28	0.14	0.06	2.4	13	1.0
Potatoes, Boiled, 2 small	79	2	18	–	Trace	20	0.11	0.04	1.5	7	0.6
Potatoes, French-Fried, 20 pieces	233	4	31	11	Trace	18	0.11	0.07	2.6	13	1.1
Potatoes, Mashed, ½ cup	63	2	13	1	20	10	0.08	0.05	1.0	23	0.4
Potato, Sweet, ½ medium	78	1	18	–	4455	12	0.05	0.04	0.4	22	0.5
Raisins, 4½ tbsp	123	1	33	–	9	Trace	0.05	0.03	0.2	26	1.5
Squash, Summer, ½ cup	16	1	3	–	462	12	0.05	0.08	0.8	26	0.4
Squash, Winter, ½ medium, ½ cup	56	2	14	–	1435	13	0.05	0.13	0.7	40	1.1
Strawberries, ½ cup	28	1	6	–	45	44	0.02	0.05	0.4	16	0.7
Tomato, ½ medium	22	1	5	–	900	23	0.06	0.04	0.7	13	0.5
Tomato Juice, ½ cup	26	1	5	–	972	19	0.06	0.04	1.0	9	1.1
Tossed Salad, ¾ cup lettuce, green pepper, radish, carrot	13	1	3	–	1380	26	0.03	0.04	0.3	26	0.6
Watermelon, 1 cup	52	1	13	–	1180	14	0.06	0.06	0.4	14	1.0

GRAIN GROUP

	Calories	Protein g	Carbohydrate g	Fat g	Vitamin A IU	Vitamin C mg	Thiamin (B_1) mg	Riboflavin (B_2) mg	Niacin mg	Calcium mg	Iron mg
Bagel	165	6	28	2	30	0	0.14	0.10	1.2	9	1.2
Biscuit, Baking Powder, enriched	103	2	13	5	Trace	Trace	0.08	0.08	0.8	34	0.4
Bread, White, slice, enriched	61	2	12	1	Trace	Trace	0.09	0.06	0.8	19	0.6
Bread, Whole Wheat, slice	55	2	11	1	Trace	Trace	0.06	0.03	0.6	22	0.5
Cornbread, 2½" x 3", enriched	191	6	30	5	264	1	0.14	0.20	0.9	93	1.2
Cornflakes, ¾ cup	72	2	16	–	0	0	0.08	0.02	0.4	3	0.3
Crackers, Graham, 2	54	1	10	1	0	0	0.01	0.03	0.2	6	0.2
Crackers, Saltines, 5	60	1	10	2	0	0	Trace	0.01	0.1	3	0.2
Hominy Grits, ½ cup, enriched	62	2	14	–	74	0	0.05	0.04	0.5	1	0.4
Noodles, Egg, ½ cup, enriched	100	3	19	1	56	0	0.11	0.06	1.0	8	0.7
Oatmeal, ½ cup	66	2	12	1	0	0	0.10	0.02	0.1	11	0.7
Pancake, 4" diameter, enriched	61	2	9	2	68	Trace	0.06	0.08	0.3	58	0.3
Rice, ½ cup	112	2	25	–	0	0	0.11	0.07	1.0	10	0.9
Roll, Frankfurter, enriched	119	3	21	2	Trace	Trace	0.16	0.10	1.3	30	0.8
Roll, Hamburger, enriched	119	3	21	2	Trace	Trace	0.16	0.10	1.3	30	0.8
Roll, Hard, enriched	156	5	30	2	Trace	Trace	0.20	0.12	1.7	24	1.2
Toast, White, slice	61	2	12	1	Trace	Trace	0.09	0.06	0.8	19	0.6
Tortilla, Corn, 6" diameter, enriched	63	2	14	1	6	0	0.04	0.02	0.3	60	0.9
Waffles, 2, 3½" x 5½", enriched	130	4	17	5	109	Trace	0.09	0.14	0.6	113	0.6

COMBINATION FOODS (foods made with ingredients from more than one food group)

Beans, Baked, Pork and Tomato Sauce, ½ cup	156	8	24	3	166	3	0.10	0.04	0.8	69	2.3
Beef and Vegetable Stew, 1 cup	209	15	15	10	2303	16	0.14	0.16	4.5	28	2.8
Chili Con Carne with Beans, 1 cup	333	19	31	15	150	–	0.08	0.18	3.3	80	4.3
Custard, Baked, ½ cup	152	7	15	7	464	Trace	0.05	0.25	0.1	148	0.5
Macaroni and Cheese, ½ cup	215	8	20	11	430	Trace	0.10	0.20	0.9	181	0.9
Pizza, Cheese, ¼ of 14" pie, enriched	354	18	43	13	945	12	0.38	0.49	3.8	332	2.7
Soup, Chicken Noodle, 1 cup	59	3	8	2	45	Trace	0.02	0.02	0.7	9	0.5
Soup, Cream of Tomato, 1 cup	173	7	23	7	1200	15	0.10	0.25	1.3	168	0.8
Spaghetti, Meat Balls and Tomato Sauce, 1 cup	332	19	39	12	1587	22	0.25	0.30	4.0	124	3.7
Taco, Beef	216	17	15	10	352	4	0.10	0.19	3.0	174	2.6

"OTHERS" Category (fats, sweets, alcohol)

Bar, Milk Chocolate, 1 oz	147	2	16	9	77	Trace	0.02	0.10	0.1	65	0.3
Beer, 1½ cups	151	1	14	0	–	–	Trace	0.11	2.2	18	Trace
Butter, 1 tsp	36	–	–	4	153	0	Trace	Trace	Trace	1	Trace
Cake, Devil's Food, 1/12 of 9" cake	234	3	40	9	104	Trace	0.02	0.06	0.2	41	0.6
Cake, Sponge, 1/12 of 10" cake	196	5	36	4	297	Trace	0.03	0.09	0.1	20	0.8
Chocolate Syrup, 2 tbsp	93	1	24	1	Trace	0	0.01	0.03	0.2	6	0.6
Coffee, Black, ¾ cup	2	–	–	–	0	0	0	Trace	0.5	3	0.2
Cookie, Sugar, 3" diameter, enriched	89	1	14	3	22	Trace	0.04	0.04	0.4	16	0.3
Doughnut, Cake Type, enriched	125	2	17	6	26	Trace	0.07	0.07	0.5	13	0.4

"OTHERS" Category (CONTINUED)

	Calories	Protein g	Carbohydrate g	Fat g	Vitamin A IU	Vitamin C mg	Thiamin (B_1) mg	Riboflavin (B_2) mg	Niacin mg	Calcium mg	Iron mg
French Dressing, 1 tbsp	66	–	3	6	–	–	–	–	–	2	0.1
Gelatin Dessert, ½ cup	71	2	17	0	–	–	–	–	–	–	–
Highball, 1½ oz whiskey with soda	97	0	–	0	–	–	–	–	–	–	–
Jelly, Currant, 1 tbsp	49	0	13	0	2	1	Trace	0.01	0	4	0.3
Mayonnaise, 1 tbsp	101	–	–	11	39	–	Trace	0.01	Trace	3	0.1
Pie, Apple, ⅛ of 9" pie, enriched	403	4	60	18	47	2	0.15	0.13	1.7	13	1.1
Popcorn, Plain, 1 cup	23	1	5	–	–	0	–	0.01	0.1	1	0.2
Potato Chips, 10 chips	114	1	10	8	Trace	3	0.04	0.01	1.0	8	0.4
Roll, Danish Pastry	274	5	30	15	202	Trace	0.05	0.10	0.5	33	0.6
Sherbet, Orange, ½ cup	135	1	29	2	93	2	0.02	0.04	0.1	52	0.2
Soft Drink, Cola, 1 cup	96	0	25	0	0	0	0	0	0	–	–
Sugar, 1 tsp	14	0	4	0	0	0	0	0	0	0	Trace
Wine, Rosé, 3½ oz	87	–	4	0	–	–	Trace	0.01	0.1	9	0.4

APPENDIX B | RECOMMENDED DAILY DIETARY ALLOWANCES

Food and Nutrition Board, National Academy of Sciences – National Research Council
Designed for the maintenance of good nutrition of practically all healthy people in the U.S.A.

	Age (years)	Weight (kg)	Weight (lbs)	Height (cm)	Height (in)	Protein (g)	Fat-Soluble Vitamins: Vitamin A (μg R.E.)†	Vitamin D (μg)	Vitamin E (mg α T.E.)	Water-Soluble Vitamins: Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg N.E.)	Vitamin B_6 (mg)	Folacin (μg)	Vitamin B_{12} (μg)	Minerals: Calcium (mg)	Phosphorus (mg)	Magnesium (mg)	Iron (mg)	Zinc (mg)	Iodine (μg)
Males	11-14	45	99	157	62	45	1000	10	8	50	1.4	1.6	18	1.8	400	3.0	1200	1200	350	18	15	150
	15-18	66	145	176	69	56	1000	10	10	60	1.4	1.7	18	2.0	400	3.0	1200	1200	400	18	15	150
	19-22	70	154	177	70	56	1000	7.5	10	60	1.5	1.7	19	2.2	400	3.0	800	800	350	10	15	150
	23-50	70	154	178	70	56	1000	5	10	60	1.4	1.6	18	2.2	400	3.0	800	800	350	10	15	150
	51+	70	154	178	70	56	1000	5	10	60	1.2	1.4	16	2.2	400	3.0	800	800	350	10	15	150
Females	11-14	46	101	157	62	46	800	10	8	50	1.1	1.3	15	1.8	400	3.0	1200	1200	300	18	15	150
	15-18	55	120	163	64	46	800	10	8	60	1.1	1.3	14	2.0	400	3.0	1200	1200	300	18	15	150
	19-22	55	120	163	64	44	800	7.5	8	60	1.1	1.3	14	2.0	400	3.0	800	800	300	18	15	150
	23-50	55	120	163	64	44	800	5	8	60	1.0	1.2	13	2.0	400	3.0	800	800	300	18	15	150
	51+	55	120	163	64	44	800	5	8	60	1.0	1.2	13	2.0	400	3.0	800	800	300	10	15	150
Pregnant						+30	+200	+5	+2	+20	+0.4	+0.3	+2	+0.6	+400	+1.0	+400	+400	+150	*	+5	+25
Lactating						+20	+400	+5	+3	+40	+0.5	+0.5	+5	+0.5	+100	+1.0	+400	+400	+150	*	+10	+50

The allowances are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses.

Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined.

*The use of supplemental iron is recommended during pregnancy and lactation.
†Based on the usual food consumption in the U.S. the RDA of 1C00 μg R.E. for vitamin A can also be expressed as 5000 IU of vitamin A activity.

APPENDIX C

SOURCES FOR SKINFOLD CALIPERS

These three skinfold calipers are relatively accurate and inexpensive devices for measuring fat.

Fat-O-Meter (approximately $9.95*)
Health Education Services Corporation
80 Fairbanks Unit 12
Addison, IL 60101
(312) 628-1787

Slim Guide (approximately $19.95*)
Creative Health Products
5148 Curtis Rd.
Plymouth, MI 48170
(313) 453-5309

Fat Control (approximately $8.95*)
Fat Control, Inc.
P.O. Box 10117
Towson, MD 21204
(301) 321-2378

The following skinfold calipers are intended for use in research – hospitals, testing centers, laboratories.

Lange Calipers (approximately $165.00*)
Cambridge Scientific Industries
Moose Lodge Rd., P.O. Box 265
Cambridge, MD 21613
(301) 228-5111

Harpenden Calipers (approximately $200.00*)
Quinton Instrument Co.
2121 Terry Ave.
Seattle, WA 98121
(206) 223-7373

*Prices subject to change.

GLOSSARY

AEROBIC
In the presence of oxygen; aerobic exercise is slow enough so the muscles can get all the oxygen needed through the respiratory and circulatory systems

ANAEROBIC
In the absence of oxygen; anaerobic exercise is too intense for the respiratory and circulatory systems to supply the oxygen needed for working muscles

CALORIES
Units of measure that express how much energy a food contains or an activity uses

DEHYDRATION
Condition which results from the excessive loss of body water

DIABETES
Disorder of carbohydrate metabolism

ENZYME
Protein compound that speeds up a chemical reaction

FAT-SOLUBLE
Dissolves in fat; fat-soluble vitamins (A, D, E, K) are dissolved in fats in the diet

FATTY ACIDS
Fat molecules that the muscles and other tissues can use for energy

GLUCOSE
Simple sugar; the type of sugar in the blood

GLYCOGEN
Long chain of glucose molecules; the form in which glucose is stored in the body for later use in physical activity

HEMOGLOBIN
Molecule found in red blood cells which contains iron and protein and carries oxygen to (and carbon dioxide away from) all body tissues including the working muscles

HORMONE
Chemical substance secreted by glands, used in growth, development, or other body functions

HYPOGLYCEMIA
Deficiency of sugar in the blood; low blood sugar

HYPERTRIGLYCERIDEMIA
Abnormally high levels of triglycerides (compounds related to fats) in the blood

INSULIN
Hormone secreted by the pancreas which regulates the blood sugar (glucose) level

LEADER NUTRIENTS
About 50 or so nutrients are needed by the human body – 10 of which are considered leader nutrients: protein, carbohydrate, fat, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron. If adequate amounts of the 10 leader nutrients are obtained in the daily diet, the other 40 or so nutrients are likely to be consumed in amounts sufficient to meet body needs

NUTRIENTS
Essential chemical substances, obtained from foods, that perform a variety of functions in the body

RECOMMENDED DAILY DIETARY ALLOWANCES (RDA)
Levels of intake of essential nutrients considered to be adequate to meet the known nutritional needs of practically all healthy persons in the United States; have been established for 17 nutrients

REHYDRATION
The replacement of excessive losses of body water

WATER-SOLUBLE
Dissolves in water; water-soluble vitamins (vitamin C and the B vitamins) dissolve in body fluids and are flushed out in the urine if taken in excessive doses

HOW TO USE THE HANDOUTS FOR ATHLETES

FOOD POWER includes a set of 12 handouts for your athletes. These handouts highlight some of the basic information on nutrition, diet, and training contained in this coach's guide. The information is combined with straightforward instructions your athletes can follow to reach their nutritional peak for competition.

Each handout is printed on a sturdy, 8½ x 11 inch card. There are several ways to give your athletes the information contained in the handouts, including:

- Posting copies of the handouts on a bulletin board or wall.
- Making copies of the handouts and distributing the copies to your athletes.

Copies can be made on an electric stencil maker, photostat copier, or master/transparency maker.

The following chart gives a brief description of each handout and the type of athlete it is designed to help. It also shows the main chapters in this guide which support and are related to the handout. Use the chart to help coordinate your use of the handouts with the nutrition and training needs of your athletes.

	Handout Title	Description	Use to Counsel	Supporting Chapters in Coach's Guide	
1A/1B	How to Build Muscles	• Factors that affect muscle building • Exercise procedure for muscle development • Diet recommendations	All athletes, particularly those who want to gain weight	Body Composition	page 21
2	How to Gain Weight	• Suggestions for increasing calories • The importance of gaining muscle	Athletes who want to gain weight	Weight Control	page 27
3	How to Lose Weight	• Calories needed for weight loss and weight maintenance • Methods for weight loss – diet and exercise	Athletes who want to lose weight	Weight Control	page 27
4A/4B	How to Measure Your Body Fat – Men	• Desirable amounts of body fat • Formula to determine percent body fat	Male athletes who need to lose or gain weight	Body Composition	page 21
5A/5B	How to Measure Your Body Fat – Women	• Desirable amounts of body fat • Formula to determine percent body fat	Female athletes who need to lose or gain weight	Body Composition	page 21
6	What You Need to Know about a Training Diet	• Importance of a high-carbohydrate diet • General guide to high-carbohydrate foods	Athletes who are in training	Food for Athletes Fuels for Sports	page 16 page 14
7	What You Need to Know about Pre-Competition Meals	• Importance of pre-competition meal • What foods to include and avoid • Sample pre-competition meals	Athletes preparing for competition	Food for Athletes	page 16
8	How to Carbohydrate Load	• Basic training and diet steps	Athletes in endurance events who can benefit from carbohydrate loading	Food for Athletes Fuels for Sports	page 16 page 14
9	What You Need to Know about Water	• Dangers of dehydration • How to avoid dehydration	All athletes	Water	page 11
10	What You Need to Know about Sports Nutrition Myths	• Common sports nutrition myths • Nutrition facts	All athletes	Sports Misinformation	page 30
11	How to Select the Diet for You	• Basic Diet • Training Diet • Carbohydrate Loading Diet	All athletes	Basics Food for Athletes	page 8 page 16
12A/12B	What You Need to Know about Food	• Alphabetical list of foods including calories and grams of protein, carbohydrate and fat for typical servings	All athletes	Appendix A	page 32

Building bigger, stronger muscles depends on three factors: heredity, exercise, and your diet.

WHY BUILD UP YOUR MUSCLES?

In contact sports like wrestling and football, only the strong survive. But stronger muscles can improve your performance in any sport. For example, stronger muscles can increase your speed when running, your force when throwing or hitting a ball, and your endurance in any athletic event. So all athletes, male and female, can benefit from stronger muscles.

The size and strength of your muscles depend on three factors: heredity, exercise, and diet.

HEREDITY

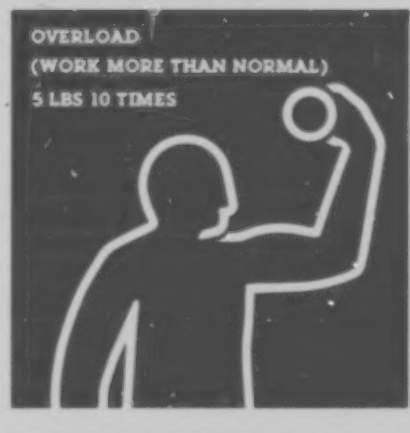
Everyone is born with a slightly different combination of two types of muscle fibers—fast-twitch and slow-twitch. Fast-twitch fibers work rapidly but tire quickly. Slow-twitch fibers don't work as fast, but they have greater endurance. Athletes with more fast-twitch fibers than slow tend to be better sprinters; those with more slow-twitch fibers than fast are better in marathons. There's nothing you can do to change this. However, you can increase the size and strength of the muscle fibers you've inherited.

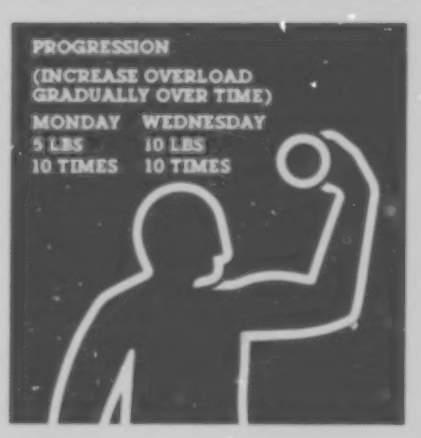
EXERCISE

Exercise programs can build larger, stronger muscles. Muscle building depends on three basic principles: specificity, overload, and progression.

- Specificity means that the specific muscle to be developed must be exercised.
- Overload means that the muscle must work more than normal to become stronger.
- Progression means that the increased work load should be taken on gradually.

YOU MUST USE ALL THREE PRINCIPLES TO INCREASE MUSCULAR STRENGTH.





0140N Copyright © 1983 National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO BUILD MUSCLES (CONTINUED)

Let's say you want to develop stronger biceps.

- To develop your biceps, do exercises like the barbell curl (specificity). Warm up with a light weight (about half the weight you can lift correctly).
- Using the barbell curl, start with a weight you can lift correctly 10 times. Try to do three sets of these during a workout.
- Once you can do three sets of 10 correctly in a workout, increase the weight five pounds (overload).
- Repeat the same steps until you can lift the new weight for three sets of 10. Then add five more pounds. As you get stronger, gradually increase the weight of the barbells (progression).
- Over a four-week period, exercising three times a week, you should see noticeable improvements in your biceps strength.
- Don't try to lift weights every day. Rest one day between workouts to give your muscles time to grow.

The principles of specificity, overload, and progression can be used to develop other muscles, too. And these principles can be applied to activities other than weight lifting, such as running to increase your leg strength.

DIET

In addition to exercise, your muscles need a nutritionally adequate diet to support muscular development. A diet that includes a wide variety of foods from the Four Food Groups (Milk, Meat, Fruit-Vegetable, and Grain) will supply your body with all the nutrients that it needs for top performance.

Despite popular opinion, you do not need massive amounts of protein to build muscles. Your muscles are only 22 percent protein and more than 70 percent water. A growing athlete only needs about ½ gram of protein for each pound of body weight. Adults need even less—about ⅓ gram per pound. So a teenager who weighs 150 pounds would need about 75 grams of protein. A 150-pound adult would need roughly 50 grams per day.

The following sample menu is nutritionally adequate and supplies more than enough protein for muscle building.

	grams of protein
MORNING:	
½ cup orange juice	1
1 egg	6
1 slice toast	2
1 cup milk	8
NOON:	
3 oz hamburger	23
hamburger bun	3
banana	1
1 cup chocolate milk	8
EVENING:	
3 oz pork chop	21
large baked potato	4
tossed salad	1
½ cup green beans	1
1 slice whole wheat bread	2
1 cup milk	8
SNACK:	
½ cup vanilla ice cream	2
2 sugar cookies	2
Total	93

When you eat more protein than your body needs, your body changes the excess protein to fat, not muscle. So extra protein does not improve your performance. In addition, high-protein diets can cause diarrhea and dehydration.

WHAT ABOUT STEROIDS?

Some body builders take steroids in the hope of developing massive muscles. However, the American Medical Association and the American College of Sports Medicine do not recommend using them. Steroids can be dangerous. These drugs can stunt your growth, cause acne, deepen your voice, and alter your sex organs. Some of these side effects can be permanent. So, instead of improving your performance, steroids may actually hurt it. Besides, studies have found that athletes who train properly and eat nutritionally adequate diets perform the same with or without steroids.

0140N Copyright © 1983 National Dairy Council, Rosemont, IL 60018 Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

To gain weight, increase your food intake by 3500 Calories for each pound you want to add.

WHY GAIN WEIGHT?

In some sports, like football and hockey, a few extra pounds can come in handy. In other sports, athletes who are underweight may not have enough energy to work at their peak performance. While in other sports, some athletes may have trouble just maintaining their normal weight.

WHAT SHOULD YOU EAT TO GAIN WEIGHT?

To gain weight, you have to take in more calories than your body burns. That is, you need to eat more food. But even then, gaining weight may not be easy for some athletes. If you're training hard, you may burn up everything you eat, and then some.

A pound of body weight equals 3500 Calories. So, to gain a pound, you need to eat 3500 Calories more than your body uses. You can realistically gain about one to two pounds in a week. That comes down to eating 500 to 1000 Calories **extra** every day.

The following basic diet for gaining weight can supply those extra calories. Eat at **least** these recommended servings every day:

MILK GROUP (milk, cheese, yogurt, cottage cheese, ice cream)	teenagers – 4 servings adults – 2 servings
MEAT GROUP (meat, fish, poultry, eggs, dry beans and peas, nuts)	2 servings
FRUIT-VEGETABLE GROUP (fresh, frozen, canned, dried, juiced fruits and vegetables)	8 servings
GRAIN GROUP (cereals, breads, rolls, pasta, muffins, pancakes, grits, rice)	8 servings

HOW DO YOU GO ABOUT IT?

There are several ways to increase the number of calories you eat. You can:

- Eat larger portions at meals.
- Eat more meals each day.
- Have snacks between meals.

You can also increase your caloric intake by substituting high-calorie foods for lower-calorie ones. Be aware, however, that some high-calorie foods are nutrient-rich. Others are low in nutrients. It's important to supply your body with all the nutrients it needs. The following foods are rich in both calories and nutrients:

- Nuts
- Dried fruits
- Shakes and malts
- Cheese
- Sandwiches
- Pizza

Foods that are high in calories but low in nutrients also have a place in a diet to gain weight. But you should eat them in addition to, not instead of, adequate amounts of nutrient-rich foods. Some high-calorie, low-nutrient foods are:

- Soft drinks
- Salty snack foods
- Cakes, pies, cookies
- Doughnuts, sweet rolls
- Jams, jellies, syrups

GAINING MUSCLE INSTEAD OF FAT

To put on muscle, you still need to eat extra calories. But if you just eat more and don't exercise, you'll gain fat. To make sure those extra calories become muscle, not fat, you must exercise. Heavy muscular workouts, like strength training, will use the extra calories to stimulate muscle cells to grow. For more information, ask for the handout **How to Build Muscles**.

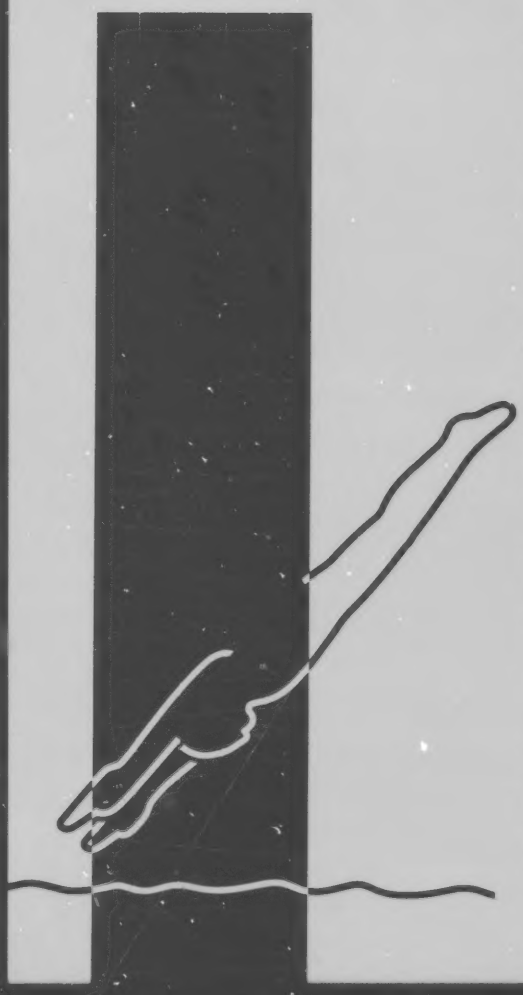
HOW CAN YOU MEASURE MUSCLE GAIN?

A scale will tell you how much weight you've gained. But it can't tell you whether that weight is muscle or fat.

To find out which you've gained, measure your body fat before you start your weight gain program. If you've gained fat, you'll see an increase in the percent body fat. If you've gained muscle, you'll see either a decrease in percent body fat or no change. To measure what you've gained, ask for the handout **How to Measure Your Body Fat – Men or Women**.

0140N Copyright © 1983 National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

Reduce your calorie intake or increase your calorie usage by 3500 Calories for each pound you want to lose.



WHY LOSE WEIGHT?

Imagine having to carry a 10-pound weight wherever you go, all day long. At first, it may be no problem. But in time, those 10 pounds will slow you down. In the same way, excess weight can be hurting your performance.

ARE YOU OVERFAT?

There's a difference between being overweight and being overfat. Some people, especially athletes, may weigh more than height/weight charts recommend. So, technically, they're overweight. But if that additional weight is from muscle, they are not overfat. And there's no need for them to lose weight.

Some experts recommend 10-12 percent body fat for men and 18-20 percent body fat for women. However, other experts have recommended that well-conditioned male athletes have 7-8 percent body fat and female athletes have 17-18 percent body fat.

To find out if you're overfat, ask for the handout **How to Measure Your Body Fat — Men or Women**. You can then see if you have any excess fat to lose.

HOW CAN YOU LOSE FAT?

It's possible to safely lose one to two pounds of body fat a week. If you lose weight any faster than that, you may begin to lose muscle too.

For each pound of fat you want to lose, you have to eliminate 3500 Calories. You can do this with diet and/or exercise.

For an athlete, diet alone is not a good way to take off pounds. Cutting your caloric intake below 2000 Calories means you won't get the energy you need for training and competition. In short, your performance may suffer.

Losing weight through exercise alone involves increasing your activity level above and beyond your normal routine. An athlete who already spends one to two hours a day in training may have a hard time adding more exercise to his or her schedule.

The fastest (and easiest) way to lose weight is with a combination of diet and exercise. If you eat 500 Calories less and exercise 500 Calories more, you have 1000 Calories less each day. At that rate, you could lose two pounds in a week.

HOW MANY CALORIES DO YOU NEED?

Scientists recommend the following caloric intakes for normally active people (light or sedentary work). If you're an athlete in training, you may be able to eat more because you are burning up more energy.

ENERGY NEEDS FOR NORMALLY ACTIVE PEOPLE

Age	Calories a day for weight maintenance	Calories a day for weight loss (weight maintenance minus 500 Calories)
Males		
11-14	2700	2200
15-18	2800	2300
19-22	2900	2400
23-50	2700	2200
51-75	2400	1900
76+	2050	1550
Females		
11-14	2200	1700
15-18	2100	1600
19-22	2100	1600
23-50	2000	1500
51-75	1800	1300
76+	1600	1100

Ask for the handout **How to Select the Diet for You**. The Basic Diet supplies about 1200 Calories for adults and 1500 Calories for teenagers. If you're an athlete in training, use the Training Diet which supplies about 2000 Calories. By limiting yourself to the minimum number of servings and choosing low-calorie foods, you can get all the nutrients you need and still lose weight.

Note: It can be difficult to meet your iron needs on a low-calorie diet without an iron supplement.

IS THERE A FAST WAY TO LOSE WEIGHT?

There are many diets around that promise quick weight loss. Usually the pounds lost are from water loss — not fat loss. If you're really interested in losing weight and keeping it off, reduce you caloric intake and/or increase your caloric usage. That way you'll lose weight by losing fat.

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO MEASURE YOUR BODY FAT—MEN

For high performance, maintain your body fat at its optimal level.

EXTRA BODY FAT IS EXTRA WORK

Your weight includes the weight of all your bones, organs, muscles, body fluids, and body fat. Of these, you can safely lose only one—body fat.

The extra weight most people have is fat. And the more fat you have, the more work you do to carry it around.

Experts have identified desirable percentages of body fat: 10 to 12 percent for trim men and 7 to 8 percent for well-conditioned male athletes.

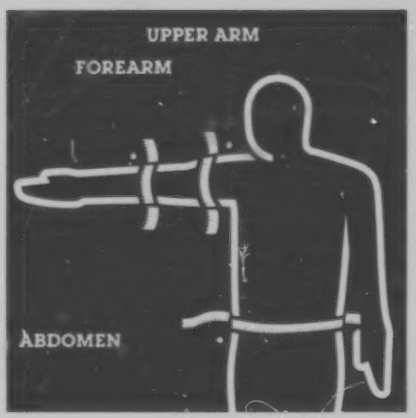
ARE YOU CARRYING TOO MUCH FAT?

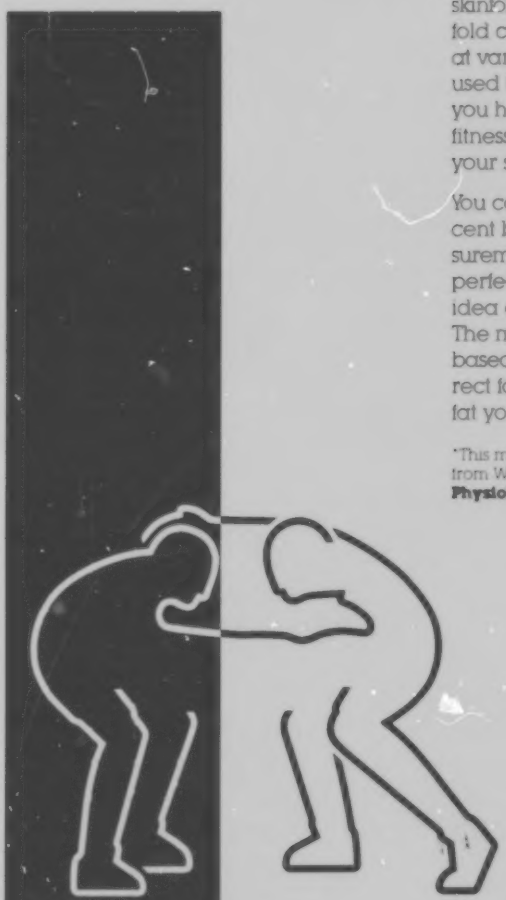
You can see if you're carrying too much fat by standing undressed in front of a mirror. Do you have any bulges or ripples that shouldn't be there? If so, you may have some excess fat.

There are other more accurate ways to estimate how much fat you have. For example, a trained expert can take your skinfold measurements with a set of skinfold calipers. Folds of skin are pinched at various places on your body and are used to estimate the percent body fat you have. Ask your coach, trainer, or fitness leader if he or she can measure your skinfolds.

You can also determine your own percent body fat by taking your own measurements. These measurements are not perfect. But they will give you a good idea of your present level of body fat. The measurements and formulas are based on your age and sex. Use the correct formula, and find out how much fat you have.

*This method of calculating body fat is adapted from W. McArdle, F. Katch and V. Katch's **Exercise Physiology.** Philadelphia: Lea and Febiger, 1981.





0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO MEASURE YOUR BODY FAT—MEN (CONTINUED)

MALES, 15 TO 26 YEARS OLD

With a measuring tape, measure:
- right upper arm (halfway between the shoulder and the elbow, with the arm straight)
- abdomen (½ inch above the navel)
- right forearm (the widest part between the elbow and wrist)

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Upper arm constant _____
Abdomen constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 10*

Approximate body fat _____ %

*For athletes, use 14 instead.

Upper Arm		Abdomen		Right Forearm	
Measurement	Constant	Measurement	Constant	Measurement	Constant
7"	26	21"	28	7"	38
8"	30	22"	29	8"	43
9"	33	23"	30	9"	49
10"	37	24"	31	10"	54
11"	41	25"	33	11"	60
12"	44	26"	34	12"	65
13"	48	27"	35	13"	71
14"	52	28"	37	14"	76
15"	56	29"	38	15"	81
16"	59	30"	39	16"	87
17"	63	31"	41	17"	92
18"	67	32"	42	18"	98
19"	70	33"	43	19"	103
20"	74	34"	45	20"	109
21"	78	35"	46	21"	114
22"	81	36"	47	22"	119
		37"	49		
		38"	50		
		39"	51		
		40"	52		
		41"	54		
		42"	55		

MALES, 27 TO 50 YEARS OLD

With a measuring tape, measure:
- buttocks (maximum protrusion with heels together)
- abdomen (½ inch above the navel)
- right forearm (the widest part between the elbow and wrist)

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Buttocks constant _____
Abdomen constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 15*

Approximate body fat _____ %

*For athletes, use 19 instead.

Buttocks		Abdomen		Right Forearm	
Measurement	Constant	Measurement	Constant	Measurement	Constant
28"	29	26"	23	7"	21
29"	30	27"	24	8"	24
30"	31	28"	25	9"	27
31"	32	29"	26	10"	30
32"	34	30"	27	11"	33
33"	35	31"	28	12"	36
34"	36	32"	29	13"	39
35"	37	33"	30	14"	42
36"	38	34"	30	15"	45
37"	39	35"	31	16"	48
38"	40	36"	32	17"	51
39"	41	37"	33	18"	54
40"	42	38"	34		
41"	43	39"	35		
42"	44	40"	36		
43"	45	41"	37		
44"	46	42"	38		
45"	47	43"	39		
46"	48	44"	40		
47"	49	45"	40		
48"	50				
49"	51				

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO MEASURE YOUR BODY FAT—WOMEN

For high performance, maintain your body fat at its optimal level.

EXTRA BODY FAT IS EXTRA WORK

Your weight includes the weight of all your bones, organs, muscles, body fluids, and body fat. Of these, you can safely lose only one—body fat.

The extra weight most people have is fat. And the more fat you have, the more work you do to carry it around.

Experts have identified desirable percentages of body fat: 18 to 20 percent for trim women and 17 to 18 percent for well-conditioned female athletes.

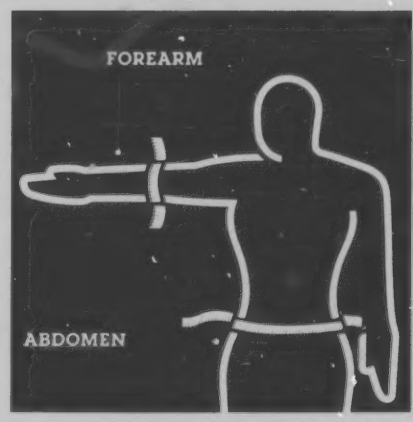
ARE YOU CARRYING TOO MUCH FAT?

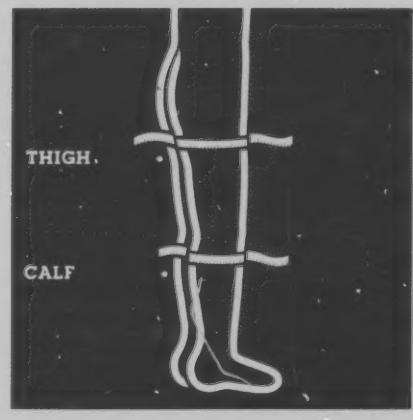
You can see if you're carrying too much fat by standing undressed in front of a mirror. Do you have any bulges or ripples that shouldn't be there? If so, you may have some excess fat.

There are other more accurate ways to estimate how much fat you have. For example, a trained expert can take your skinfold measurements with a set of skinfold calipers. Folds of skin are pinched at various places on your body and are used to estimate the percent body fat you have. Ask your coach, trainer, or fitness leader if he or she can measure your skinfolds.

You can also determine your own percent body fat by taking your own measurements. These measurements are not perfect. But they will give you a good idea of your present level of body fat. The measurements and formulas are based on your age and sex. Use the correct formula, and find out how much fat you have.

*This method of calculating body fat is adapted from W McArdle, F Katch and V Katch's **Exercise Physiology.** Philadelphia: Lea and Febiger, 1981





0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO MEASURE YOUR BODY FAT—WOMEN (CONTINUED)

FEMALES, 15 TO 26 YEARS OLD

With a measuring tape, measure:
- abdomen (½ inch above the navel)
- right thigh (just below the buttocks)
- right forearm (the widest part between the elbow and wrist)

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Abdomen constant _____
Thigh constant + _____

Subtotal _____
Forearm constant − _____

Subtotal _____
− 20*

Approximate body fat _____ %

*For athletes, use 23 instead.

Abdomen		Right Thigh		Right Forearm	
Measurement	**Constant**	**Measurement**	**Constant**	**Measurement**	**Constant**
20"	27	14"	29	6"	26
21"	28	15"	31	7"	30
22"	29	16"	33	8"	34
23"	31	17"	35	9"	39
24"	32	18"	37	10"	43
25"	33	19"	40	11"	47
26"	35	20"	42	12"	52
27"	36	21"	44	13"	56
28"	37	22"	46	14"	60
29"	39	23"	48	15"	65
30"	40	24"	50	16"	69
31"	41	25"	52	17"	73
32"	43	26"	54	18"	78
33"	44	27"	56	19"	82
34"	45	28"	58	20"	86
35"	47	29"	60		
36"	48	30"	62		
37"	49	31"	65		
38"	51	32"	67		
39"	52	33"	69		
40"	53	34"	71		

FEMALES, 27 TO 50 YEARS OLD

With a measuring tape, measure:
- abdomen (½ inch above the navel)
- right thigh (just below the buttocks)
- right calf (the widest part halfway between the ankle and knee)

Write the **constants** for the measurements in the formula. DON'T USE THE ACTUAL MEASUREMENTS IN THIS FORMULA. Then do the necessary addition and subtraction.

Abdomen constant _____
Thigh constant + _____

Subtotal _____
Calf constant − _____

Subtotal _____
− 18*

Approximate body fat _____ %

*For athletes, use 21 instead.

Abdomen		Right Thigh		Right Calf	
Measurement	**Constant**	**Measurement**	**Constant**	**Measurement**	**Constant**
25"	30	14"	17	10"	14
26"	31	15"	19	11"	16
27"	32	16"	20	12"	17
28"	33	17"	21	13"	19
29"	34	18"	22	14"	20
30"	36	19"	23	15"	22
31"	37	20"	24	16"	23
32"	38	21"	26	17"	25
33"	39	22"	27	18"	26
34"	40	23"	28	19"	27
35"	42	24"	29	20"	29
36"	43	25"	31	21"	30
37"	44	26"	32	22"	32
38"	45	27"	33	23"	33
39"	46	28"	35	24"	35
40"	48	29"	36	25"	36
41"	49	30"	37		
42"	50	31"	38		
43"	51	32"	40		
44"	52	33"	41		
45"	53	34"	42		

©1983 Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

WHAT YOU NEED TO KNOW ABOUT A TRAINING DIET

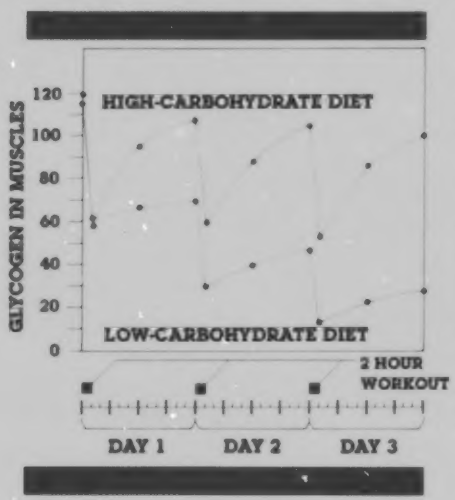
Eat a diet high in carbohydrate throughout the season for energy to train and to compete.

WHY IS CARBOHYDRATE IMPORTANT FOR PERFORMANCE?

Fatigue is common after hard physical training day-after-day, especially when you work out twice a day. You might blame your exhaustion on a "bad day." But if you are always tired, it might be due to your diet.

When you exercise, you draw on energy stored as carbohydrate in muscles. This energy comes from the foods you have eaten. During a two-hour workout, you can easily use up all your stored carbohydrate. Unless you are eating enough foods high in carbohydrate, the carbohydrate level in your muscles will not be replenished for the next day's training.

The chart below shows the difference in muscle carbohydrate levels between athletes eating a high-carbohydrate diet and the same athletes eating a low-carbohydrate diet.



Suppose you eat a diet low in carbohydrate. After just three days of two-hour workouts, your muscle carbohydrate can be nearly used up. You are a candidate for fatigue. However, on a high-carbohydrate diet after the same workouts, your muscle carbohydrate level can be almost as high as it was before you began training. So you can have the energy to train and compete at your top performance level by eating a diet high in carbohydrate throughout the season.

PLANNING THE TRAINING DIET

The main difference between the training diet and your normal diet is that the training diet is probably higher in carbohydrate. In particular, the training diet includes more foods from the Grain Group and Fruit-Vegetable Group, which are excellent sources of carbohydrate.

Of course, you still need protein, fat, vitamins, minerals, and water in your diet. You get these nutrients, as well as carbohydrate, by eating a variety of foods from each of the Four Food Groups (Milk, Meat, Fruit-Vegetable, and Grain).

When planning a high-carbohydrate diet, remember:

- Cereals, breads, pasta, muffins, pancakes, rolls, and other grain products are high in carbohydrate.
- All fruits and vegetables are also good sources of carbohydrate.
- Yogurt, milkshakes, milk, cocoa, and ice cream all contain carbohydrate.
- With the exception of dry beans and peas (like refried beans or blackeye peas), foods from the Meat Group are low in carbohydrate.
- Cakes, pies, cookies, soft drinks, and other sugary foods are high in carbohydrate. However, they are low in most other nutrients. Select them only after you've eaten the recommended number of servings from the Four Food Groups.

To get specific training diet recommendations, ask for a copy of the handout **How to Select the Diet for You**. To help you plan your own training diet, use the handout **What You Need to Know about Food**.

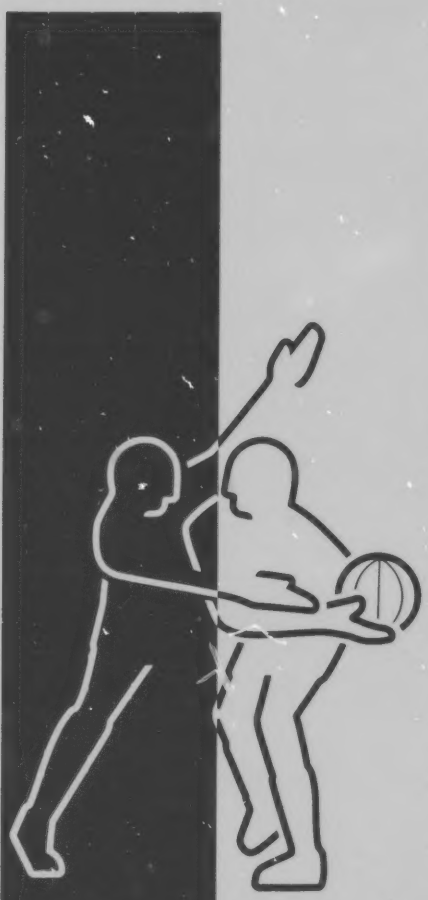
0140N Copyright © 1983 National Dairy Council Rosemont IL 60018 Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes

WHAT YOU NEED TO KNOW ABOUT PRE-COMPETITION MEALS

For the pre-competition meal, eat high-carbohydrate foods three to four hours before the event.

WHY THE PRE-COMPETITION MEAL?

The purpose of the pre-competition meal **is not** to supply extra energy for competition. Energy from the pre-competition meal will not reach your muscles in time to help your performance. The purpose of the pre-competition meal **is** to keep you from feeling hungry before and during the event. This is important so that you are physically comfortable and mentally alert.



WHY HIGH-CARBOHYDRATE FOODS?

Your pre-competition meal should include moderate portions of high-carbohydrate foods because these take the least time to pass through your stomach. High-fat and high-protein foods stay in the stomach longer than high-carbohydrate foods. Foods which remain in the stomach during competition may cause indigestion, nausea, and even vomiting.

Most foods from the Fruit-Vegetable Group and the Grain Group are excellent sources of carbohydrate and are digested quickly. High-protein foods, like lowfat dairy foods and lean meats (tuna, baked ham, broiled chicken), take longer to digest. However, these foods may be safely included in your pre-competition meal, as long as you eat them in moderate portions.

Pre-competition meals should avoid...
- Foods like hamburger, sausage, lunch meats, and peanut butter.
- Fried foods like doughnuts, chips, french fries, and fried fish or chicken.
- Condiments like mayonnaise and salad dressings.

Because these foods are high in fat, they take the longest time to pass through the stomach. If you include any of these foods in your pre-competition meal, keep them to small amounts.

HIGH-CARBOHYDRATE FOODS

In your pre-competition meal, be sure to include several high-carbohydrate foods. The foods in the chart are examples of good sources of carbohydrate.

MILK GROUP

Lowfat milk	Pudding
Lowfat yogurt	Skim milk

MEAT GROUP

Blackeye peas	Pinto beans
Navy beans	Refried beans

FRUIT-VEGETABLE GROUP

Bananas	Peas
Carrots	Potatoes (baked, boiled, or mashed)
Corn	Raisins
Grapes	Tomatoes
Peaches	

GRAIN GROUP

Bagel	Pasta
Cornflakes	Rice
Crackers	White bread
Hard roll	Whole wheat bread
Oatmeal	

SOME SAMPLE PRE-COMPETITION MEALS

Four sample pre-competition meals are listed below. Notice that each contains plenty of high-carbohydrate foods, lowfat milk products, and a beverage or other source of fluid. Use these and the handout **What You Need to Know about Food** as guides for planning your own pre-competition meals.

SAMPLE MEAL #1:
Orange juice, cornflakes with a sliced banana, whole wheat toast with jelly, and skim milk.

SAMPLE MEAL #2:
Vegetable soup, chicken sandwich on wheat bread, applesauce, and lowfat strawberry yogurt.

SAMPLE MEAL #3:
Julienne salad (lettuce and other fresh vegetables with thin strips of cheese and turkey), a hard roll, pudding, and grape juice.

SAMPLE MEAL #4:
Pork and beans, crackers, carrot sticks, fruit cup, and skim milk.

EATING JUST BEFORE COMPETITION

No foods, not even high-carbohydrate foods, should be eaten an hour or less before competition. If you compete with food in your stomach, you may get an upset stomach. Eating high-sugar foods, such as candy and soft drinks, may also hurt your performance by producing low blood sugar. When this happens, you may feel very tired or even weak.

The only thing you should take before competition is plenty of plain, cool water so you don't overheat.

Remember these guidelines when choosing your pre-competition meal:
- Eat your pre-competition meal three to four hours before the event.
- Choose meals that include mostly foods high in carbohydrate and low in fat.

50

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

HOW TO CARBOHYDRATE LOAD

Athletes in endurance events can store up extra energy for competition by carbohydrate loading.

WHAT IS CARBOHYDRATE LOADING?

Carbohydrate is the main fuel an athlete uses during exercise. Carbohydrate loading is a way to store two to three times the normal amount of carbohydrate in the muscle. By combining a special diet and training program, you temporarily trick your body into overstocking carbohydrate. This is helpful for endurance athletes.

WHO SHOULD CARBOHYDRATE LOAD?

Normally your muscles can store only enough carbohydrate to keep the body moving for about two hours. So, athletes involved in events lasting more than 1-1½ hours may benefit from carbohydrate loading. Some of the sports where carbohydrate loading may help are: cross-country skiing, distance running, distance swimming, long-duration cycling, soccer, and tournament tennis.

Carbohydrate loading offers no advantage to athletes in short events (like sprints) or non-continuous, stop-and-start events such as volleyball, football, or basketball. If you participate in one of these sports, ask for the handout **What You Need to Know about a Training Diet.** This handout will show you how to eat a diet that will help you perform at your top level.

HOW DO YOU CARBOHYDRATE LOAD?

Carbohydrate loading is a training and diet plan that lasts eight days. The training portion has three parts:

- A long, hard training session which uses up the carbohydrate in your muscles seven days before competition.
- Three days of moderate training – which means you cut back your workouts to one-half to one-third of your usual effort.
- Three days of rest to allow your muscles to store carbohydrate.

The diet has two parts:

- The Basic Diet is eaten on the day of long, hard training and during the three days of moderate training.
- The Carbohydrate-Loading Diet is eaten for three days before the event while you are resting from training.

HOW DOES CARBOHYDRATE LOADING WORK?

The four days of training combined with the Basic Diet deplete the carbohydrate stores in the muscles. Once you take a rest from training and start eating the Carbohydrate-Loading Diet, you store more carbohydrate in your muscles than normal – as much as two to three times more.

Carbohydrate loading depends on working the training and diet schedules together correctly.

Carbohydrate Loading Plan

Day	Training	Diet
7	Long, hard	Basic diet
6	Moderate	Basic diet
5	Moderate	Basic diet
4	Moderate	Basic diet
3	Rest	Carbohydrate-loading diet
2	Rest	Carbohydrate-loading diet
1	Rest	Carbohydrate-loading diet
0	Competition	Pre-competition meal

WHAT SHOULD YOU EAT WHEN CARBOHYDRATE LOADING?

To load up on carbohydrate, you need to follow this training and diet program closely. To get specific guidelines for these diets, ask for the handout **How to Select the Diet for You.** Use the Basic Diet for the first four days and the Carbohydrate-Loading Diet on the three days before competition.

ARE THERE ANY PROBLEMS WITH CARBOHYDRATE LOADING?

There are a few. First, you will gain weight. This is due to water being held in the muscle with the extra carbohydrate. The weight gain may vary from two to seven pounds. (You can "see" if you're storing carbohydrate by weighing yourself while carbohydrate loading.)

Another problem with carbohydrate loading is that some athletes don't tolerate the change in eating and training habits psychologically. So athletes should use carbohydrate loading only two to three times a year.

You can modify this program to fill your carbohydrate stores, without "overfilling" them. Start with Day 3 of the carbohydrate-loading plan. Use the Carbohydrate-Loading Diet for three days before competition, while you rest from training. With this short program, you replace the carbohydrate used up in training. But you will not store two to three times the normal amount. The short program can be used year round for all competitions.

0140N Copyright © 1983 National Dairy Council, Rosemont, IL 60018 Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

Don't wait until

you're thirsty.

Drink water before,

during, and after exercise

to replace fluids lost

as sweat.

At one time athletes mistakenly thought it was a good idea to limit their water intake. We now know that this is **very dangerous.**

WHAT DOES WATER DO FOR YOU?

Water is an important nutrient for you as an athlete. Water makes up 60 percent of your total body weight and 70 percent of your muscles. Without enough water, you can't work at your top level of performance and you may even harm yourself.

The most important thing you should remember about water is that it cools your body. As you exercise, your body temperature increases (even when it's cold outside). As your temperature increases, you sweat. When the sweat evaporates from your skin, your body cools down.

WHAT HAPPENS WITHOUT WATER?

Dehydration. If you start a physical activity without having enough water in your body or if you sweat during practice and do not replace the water lost, you may become dehydrated. You can become dehydrated even when you lose just a few pounds as sweat. Once you become dehydrated, you can no longer sweat and get rid of the heat that builds up as you exercise.

Dehydration can be dangerous. The first symptoms of dehydration include thirst, chills, clammy skin, throbbing heart beat, and nausea. When you become more dehydrated, you may develop a headache, cramps, shortness of breath, dizziness, and/or dryness in the mouth.

At the most serious level of dehydration, you can experience hallucinations, deafness, visual problems, swollen tongue, and/or kidney failure.

HOW CAN YOU AVOID DEHYDRATION?

- Drink plenty of cool, plain water before, during, and after practice and competition as a preventive measure. Even if you don't feel thirsty.
  —Drink 1-1½ cups of plain, cool water 15 minutes before competition or practice.
  —Drink ½ cup of water every 10-15 minutes during the event.
- Don't rely on thirst alone as a guide to how much water your body needs. Weigh yourself before and after exercising. For every pound lost as sweat, drink two cups of fluid.
- Avoid sport drinks before or during the game. Because they contain salt or sugar, they are not absorbed by the body as quickly as water.
- Avoid salt tablets. Too much salt draws water into your stomach to dissolve and dilute it. Salt tablets can also irritate your stomach and cause nausea.
- Avoid working out in plastic or rubber suits which can cause serious dehydration, limit your performance, and lead to heat exhaustion and heat stroke.

WHAT HAPPENS IF YOUR SWEAT DOESN'T EVAPORATE?

In order for your body to cool down, two things must occur. You must sweat. And the sweat must evaporate from your skin. When the weather is hot and humid or when you are wearing heavy gear, you will sweat. But the sweat may not evaporate quickly enough to cool your body down and you can become overheated. You can avoid problems by following these tips when exercising during hot, humid weather.

- Exercise at the coolest time of the day — early morning or late evening. Avoid the middle of the day when the temperature is usually the highest. If you must practice then, build up your tolerance to heat by working out for a short time each day. Gradually increase the length of each workout.
- Wear the lightest clothing and equipment you can. Mesh jerseys, lightweight shorts, and low-cut socks allow more sweat to evaporate than sweat suits and heavy gear.
- Drink plenty of water before, during, and after workouts, practice, and competition.

When you exercise in cold weather, your body still sweats. To keep warm and yet allow the sweat to evaporate, wear several layers of loose clothing. Layers of clothing will trap the warmth from your body while absorbing your sweat. If you become too warm, a layer can be removed to allow more cooling. And remember, even in cold weather you need to drink water.

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

WHAT YOU NEED TO KNOW ABOUT SPORTS NUTRITION MYTHS

No food, drug,

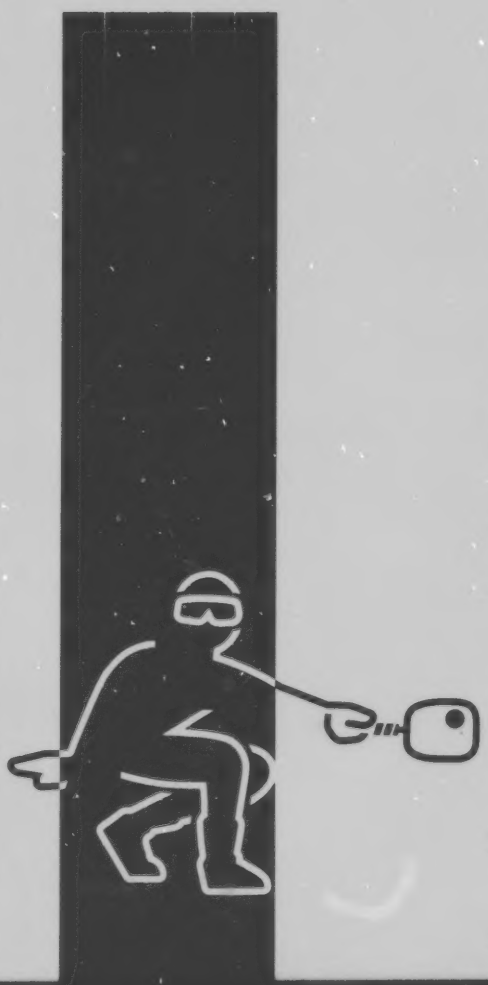
or nutrient can

quickly and easily

build muscles,

increase speed,

or improve endurance.



DO YOU BELIEVE NUTRITION MYTHS?

Serious athletes are always looking for ways to improve their performance. Unfortunately, many athletes want to improve themselves so much that they will try almost anything. They may be easily fooled by promotional claims for foods, drugs, or nutrients that promise miraculous improvement. Athletes may also be told, wrongly, to avoid eating some foods which really are healthful. Athletes should watch out for the following sports nutrition myths.

MUSCLE-BUILDING MYTHS

▪ The more protein and protein supplements you eat, the more muscle you will have.

NO. There is no evidence that excess protein will lead to more or better muscles. In fact, excess protein—like excess fat and excess carbohydrate—will be stored by the body as fat. Too much protein, combined with too little water, may cause kidney or liver disorders. A normal diet supplies more than enough protein for muscle growth.

▪ Taking steroids will develop massive muscles.

NO. There is no proof that steroids can increase muscle growth or strength. Steroids are powerful drugs that can be dangerous. Taking steroids can stunt your growth, cause acne, deepen your voice, and alter your sex organs.

QUICK-ENERGY MYTHS

▪ Eating honey, sugar, soft drinks, or any sweets just before competition will provide a burst of quick energy.

NO. When high-carbohydrate foods are eaten an hour or less before competition, they may produce low blood sugar. When this happens, the amount of insulin in the blood rises and the sugar in the blood is removed too quickly. With low blood sugar, an athlete may feel tired or even weak.

▪ Vitamins will give you more energy.

NO. Not one of the 14 known vitamins supplies energy. It's true that some vitamins help the body use energy. However, these vitamins are easily supplied by an athlete's normal diet. Megadoses of vitamins won't give you more energy or improve your endurance.

If you consume more vitamin C or B vitamins than your body needs, they are simply flushed out in your urine. If you consume more vitamins A and D than you need, they are stored in your fat. Too much of these vitamins can be poisonous.

▪ Amphetamines give you more energy to compete.

NO. There is no proof that amphetamines give you more energy or improve your performance. However, there is proof that amphetamines can be harmful. Among the side effects of using them are a rise in blood pressure, pulse rate, breathing rate, metabolism, and blood sugar. Amphetamines can also cause headaches, dizziness, and confusion which can interfere with your ability to perform. Finally, the possibility of addiction makes amphetamines a poor choice for the serious athlete.

PERFORMANCE MYTHS

▪ Water during exercise causes upset stomach and slows you down.

NO. There is no evidence that water taken during exercise causes upset stomach or any other problems. In fact, drinking water during exercise is very important. Drinking ½ cup of water every 10-15 minutes during exercise helps replace body fluids lost as sweat.

▪ Drinking milk causes cotton mouth.

NO. Cotton mouth (dry mouth due to lack of saliva) seems to result from emotional stress and a loss of body fluids, not from drinking milk.

▪ Muscle cramps are caused by inadequate salt intake.

NO. Cramps are caused by severe losses of water through sweating. Drinking water before, during, and after practice and competition can prevent these water losses. Salt tablets can aggravate this condition by drawing more water out of the muscle and into the stomach.

Athletic success is not a miracle. It results from a combination of natural talent, hard training, and plenty of preparation before competition. Athletes who rely on nutrition myths instead of following a sensible training program and diet can hurt their bodies and their performance.

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018 Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes

	BASIC DIET*	TRAINING DIET*	CARBOHYDRATE LOADING DIET*
As an athlete, you need about 50 or so nutrients for top performance. You can get these nutrients by including the recommended number of servings daily from each food group and by choosing a variety of foods from within each food group. The most important nutrients supplied by each food group are listed with each group.	To be used by: ■ Athletes during the off season ■ Endurance athletes on the first 4 days of carbohydrate loading ■ Anyone, as a weight loss diet	To be used by: ■ Athletes throughout the training season	To be used by: ■ Endurance athletes 3 days before competition
FOUR FOOD GROUPS	**RECOMMENDED DAILY SERVINGS**	**RECOMMENDED DAILY SERVINGS**	**RECOMMENDED DAILY SERVINGS**
MILK GROUP Milk, cheese, yogurt, cottage cheese, ice cream calcium, riboflavin, protein	teenagers: 4 or more adults: 2 or more	teenagers: 4 or more adults: 2 or more	teenagers: 4-5 adults: 2-3
MEAT GROUP Meat, fish, poultry, eggs, dry beans and peas, nuts protein, niacin, iron, thiamin	2 or more	2 or more	2-3
FRUIT-VEGETABLE GROUP Fresh, frozen, canned, dried and juiced fruits and vegetables vitamin A, vitamin C	4 or more	8 or more	8 or more
GRAIN GROUP Cereals, breads, rolls, pasta, muffins, pancakes, grits carbohydrate, thiamin, iron, niacin	4 or more	8 or more	12 or more
"OTHERS" Category Cakes, cookies, pies, candy, soft drinks, chips, fats, alcohol carbohydrate, fat	No recommendation. Select foods from the "Others" Category if you can afford the calories after eating the recommended servings from the Four Food Groups.	No recommendation. Select foods from the "Others" Category if you can afford the calories after eating the recommended servings from the Four Food Groups.	No recommendation. Select foods from the "Others" Category if you can afford the calories after eating the recommended servings from the Four Food Groups.
For additional information, use the handouts:	■ How to Carbohydrate Load ■ How to Lose Weight ■ What You Need to Know about Food	■ What You Need to Know about a Training Diet ■ What You Need to Know about Food	■ How to Carbohydrate Load ■ What You Need to Know about Food

*Check with your doctor before going on any of these diets.

0140N Copyright © 1983, National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

WHAT YOU NEED TO KNOW ABOUT FOOD

Whether you're in training or just trying to get in shape, your diet is important to your performance. This chart can help you plan your special diet. It lists foods alphabetically within each food group. Calories are given for a typical serving. Calories come from protein (4 Calories per gram), carbohydrate (4 Calories per gram), and fat (9 Calories per gram). The approximate amounts of each of these nutrients are also listed. Use this information to plan a diet tailored to your needs.

TRAINING DIET– include at least 350 grams of carbohydrate each day

PRE-COMPETITION MEAL– include several high-carbohydrate foods (foods higher in carbohydrate than fat and protein); avoid fried foods

WEIGHT LOSS DIET– include at least 1500 Calories per day during the off season (1200 Calories if you're over 18 years old); include at least 2000 Calories per day during training

WEIGHT GAIN DIET– increase calories by about 500-1000 per day for a one- to two-pound weight gain per week

CARBOHYDRATE LOADING– include 350 grams of carbohydrate daily in the training phase; include at least 550-650 grams of carbohydrate daily in the loading phase

	Calories	Protein g	Carbohydrate g	Fat g
MILK GROUP				
Buttermilk, 1 cup	99	8	12	2
Cheese, American, 1 slice	106	6	–	9
Cheese, Cheddar, 1 slice	114	7	–	9
Cheese, Cottage, ½ cup	109	13	3	5
Cheese, Swiss, 1 slice	107	8	1	8
Cocoa, ¾ cup	164	7	19	7
Ice Cream, Vanilla, ½ cup	135	2	16	7
Milk, 1 cup	150	8	11	8
Milk, Chocolate, 1 cup	208	8	26	8
Milk, Lowfat (2%), 1 cup	121	8	12	5
Milk, Skim, 1 cup	86	8	12	–
Milkshake, Chocolate, 10.6 oz	356	9	63	8
Pudding, Chocolate, ½ cup	161	4	30	4
Yogurt, Strawberry, 1 cup	225	9	42	3
MEAT GROUP				
Bacon, 2 slices	92	5	1	8
Beans, Refried, ½ cup	142	9	26	1
Beef, Roast, 3 oz	182	26	0	8
Beef Liver, 3 oz	195	23	5	9
Bologna, 1 slice	86	3	–	8
Chicken, Fried, 3 oz	201	26	2	9
Egg, Fried, large	83	5	1	6
Egg, Hard-Cooked, large	79	6	1	6
Egg, Scrambled, large	95	6	1	7
Frankfurter, 2 oz	172	7	1	15
Ham, Baked, 3 oz	179	26	0	8
Meat Loaf, 3 oz	230	15	13	12
Meat Patty, 3 oz	186	23	0	10
Peanut Butter, 2 Tbsp	186	9	6	16
Peanuts, Salted, ¼ cup	211	9	7	18
Peas, Blackeye, Immature, ½ cup	134	10	22	1
Peas, Blackeye, Mature, ½ cup	94	6	17	–
Perch, Fried, Breaded, 3 oz	193	16	6	11
Pork Chop, 3 oz	308	21	0	24
Sausage, 2 links	135	5	–	13
T-Bone Steak, 3½ oz	212	29	0	10
Tuna, 3 oz	168	25	0	7

©MCMLXXXIII National Dairy Council, Rosemont, IL 60018. Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.

	Calories	Protein g	Carbohydrate g	Fat g
FRUIT-VEGETABLE GROUP				
Apple, medium	80	–	20	1
Applesauce, ½ cup	116	–	30	–
Apricots, Dried, 4 halves	39	1	10	–
Asparagus, 4 spears, ½ cup	12	1	2	–
Banana, medium	101	1	26	–
Beans, Green, ½ cup	16	1	3	–
Beans, Lima, ½ cup	94	7	17	–
Broccoli, stalk, ½ cup	20	2	4	–
Cabbage, ⅛ head, ½ cup	13	1	3	–
Cantaloupe, ¼ medium	29	1	7	–
Carrots, ½ cup	22	1	5	–
Carrot Sticks, 5" carrot	21	1	5	–
Cauliflower, ½ cup	13	1	3	–
Celery Sticks, 8" stalk	10	1	2	–
Coleslaw, ½ cup	82	1	3	8
Corn, ½ cup	70	2	16	1
Corn, 5" ear	114	4	26	1
Fruit Salad, ½ cup	99	2	25	1
Grapefruit, Pink, ½ medium	48	1	13	–
Grapes, ½ cup	48	–	12	–
Greens, ½ cup	17	2	3	–
Lettuce, ⅛ head, ½ cup	10	1	2	–
Okra, 4 pods, ½ cup	12	1	3	–
Onions, ½ cup	30	1	7	–
Orange, medium	65	1	16	–
Orange Juice, ½ cup	56	1	13	–
Peaches, ½ cup	100	1	26	–
Pear, medium	101	1	25	1
Peas, Green, ½ cup	54	4	9	–
Pineapple, large slice	90	–	24	–
Potato, Baked, large	132	4	30	–
Potatoes, Boiled, 2 small	79	2	18	–
Potatoes, French-Fried, 20	233	4	31	11
Potatoes, Mashed, ½ cup	63	2	13	1
Potato, Sweet, ½ medium	78	1	18	–
Raisins, 4½ Tbsp	123	1	33	–
Squash, Summer, ½ cup	16	1	3	–
Squash, Winter, ½ cup	56	2	14	–
Strawberries, ½ cup	28	1	6	–
Tomato, ½ medium	22	1	5	–
Tomato Juice, ½ cup	26	1	5	–
Tossed Salad, ½ cup	13	1	3	–
Watermelon, 1 cup	52	1	13	–
GRAIN GROUP				
Bagel	165	6	28	2
Biscuit, Baking Powder	103	2	13	5
Bread, White, slice	61	2	12	1
Bread, Whole Wheat, slice	55	2	11	1
Cornbread, 2½"x3"	191	6	30	5
Cornflakes, ¾ cup	72	2	16	–
Crackers, Graham, 2	54	1	10	1
Crackers, Saltines, 5	60	1	10	2
Hominy Grits, ½ cup	62	2	14	–
Noodles, Egg, ½ cup	100	3	19	1
Oatmeal, ½ cup	66	2	12	1
Pancake, 4" diameter	61	2	9	2
Rice, ½ cup	112	2	25	–
Roll, Frankfurter	119	3	21	2
Roll, Hamburger	119	3	21	2
Roll, Hard	156	5	30	2
Toast, White, slice	61	2	12	1
Tortilla, Corn, 6" dia	63	2	14	1
Waffles, 2, 3½"x5½"	130	4	17	5

	Calories	Protein g	Carbohydrate g	Fat g
COMBINATION FOODS (foods made with ingredients from more than one food group)				
Beans, Baked, Pork & Tomato Sauce, ½ cup	156	8	24	3
Beef & Vegetable Stew, 1 cup	209	15	15	10
Chili Con Carne, 1 cup	333	19	31	15
Custard, Baked, ½ cup	152	7	15	7
Macaroni & Cheese, ½ cup	215	8	20	11
Pizza, Cheese, ¼ of 14" pie	354	18	43	13
Soup, Chicken Noodle, 1 cup	59	3	8	2
Soup, Cream of Tomato, 1 cup	173	7	23	7
Spaghetti & Meat Balls, 1 cup	332	19	39	12
Taco, Beef	216	17	15	10
"OTHERS" Category (fats, sweets, and alcohol)				
Bar, Milk Chocolate, 1 oz	147	2	16	9
Beer, 1½ cups	151	1	14	0
Butter, 1 tsp	36	–	–	4
Cake, Devil's Food, ⅙ of 9" cake	234	3	40	9
Cake, Sponge, ⅟₁₂ of 10" cake	196	5	36	4
Chocolate Syrup, 2 Tbsp	93	1	24	1
Coffee, Black, ¾ cup	2	–	–	–
Cookie, Sugar, 3" diameter	89	1	14	3
Doughnut, Cake Type	125	2	17	6
French Dressing, 1 Tbsp	66	–	3	6
Gelatin Dessert, ½ cup	71	2	17	0
Highball, 1½ oz	97	0	–	0
Jelly, Currant, 1 Tbsp	49	0	13	0
Mayonnaise, 1 Tbsp	101	–	–	11
Pie, Apple, ⅙ of 9" pie	403	4	60	18
Popcorn, Plain, 1 cup	23	1	5	–
Potato Chips, 10 chips	114	1	10	8
Roll, Danish Pastry	274	5	30	15
Sherbet, Orange, ½ cup	135	1	29	2
Soft Drink, Cola, 1 cup	96	0	25	0
Sugar, 1 tsp	14	0	4	0
Wine, Rose, 3½ oz	87	–	4	0

©NDN Copyright © 1983 National Dairy Council, Rosemont, IL 60018 Printed in U.S.A.
Material protected by this copyright may be reproduced for educational purposes.